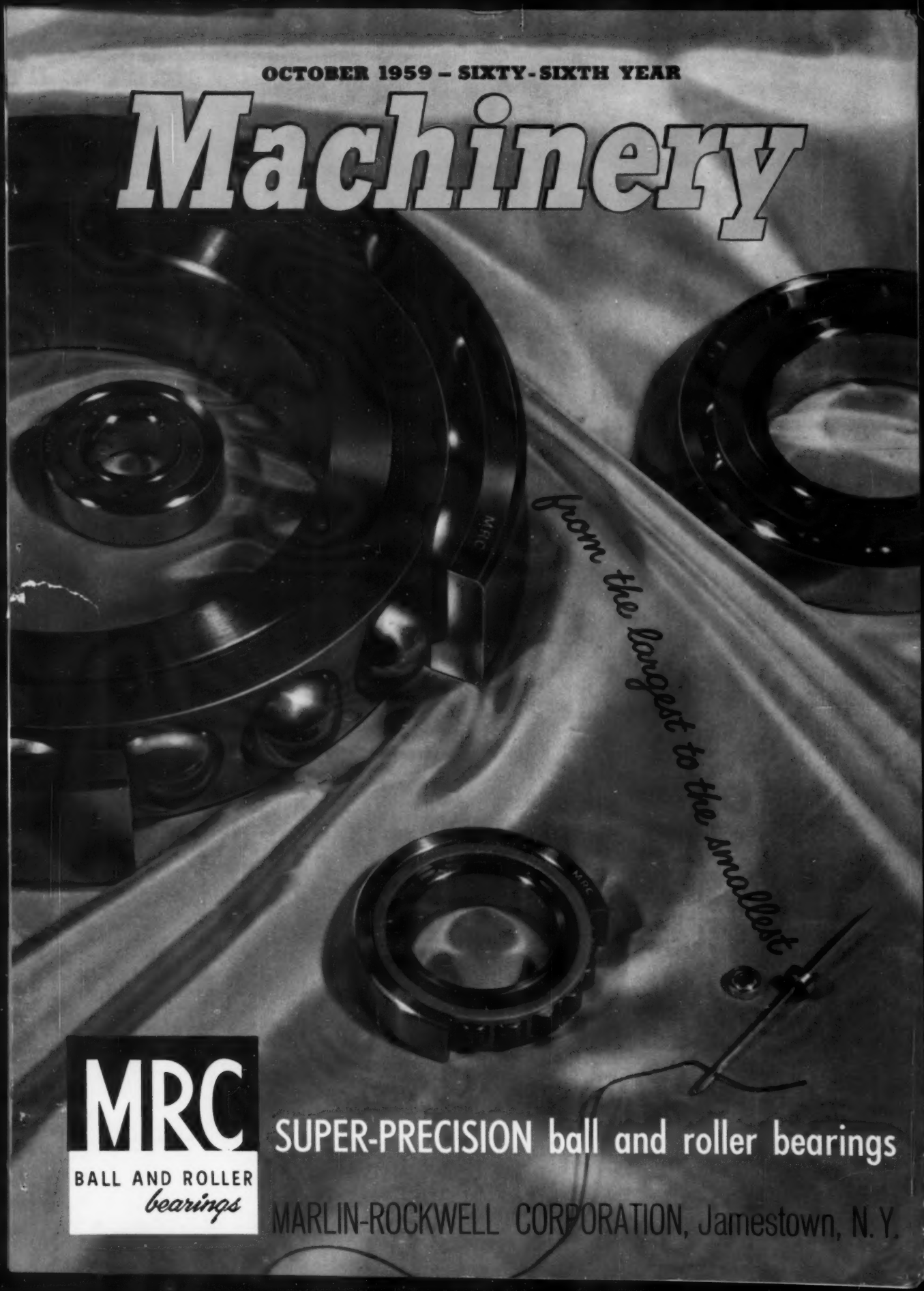
OCTOBER 1959 – SIXTY-SIXTH YEAR

# Machinery

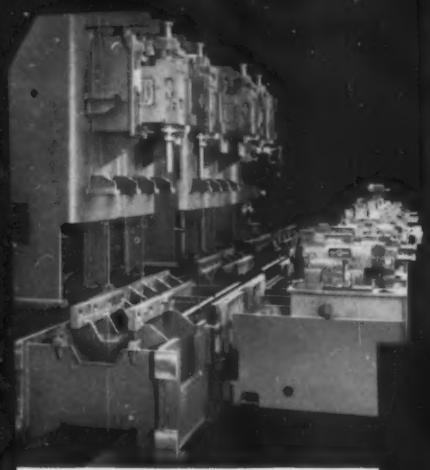



MRC
BALL AND ROLLER
bearings

SUPER-PRECISION ball and roller bearings

MARLIN-ROCKWELL CORPORATION, Jamestown, N.Y.

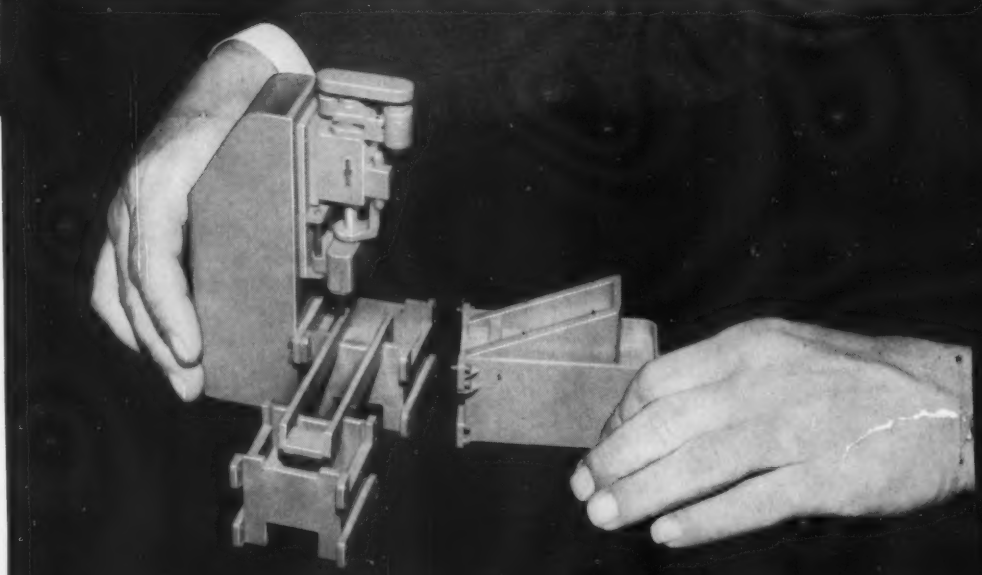
# BUILDING-BLOCK AUTOMATION...



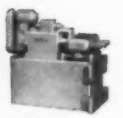
This 15-station Model S Bore-Matic, in process of assembly at Heald, shows the application of standard base and wing components for vertical and horizontal mounting of 20 Heald BORIZERS. Machine will perform 174 drilling, spot drilling, tapping, spot facing, core drilling, reaming and gun drilling operations on automotive transmission valve bodies.



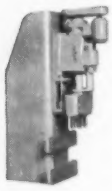
Scale model of standard building-block units for automated Borizing equipment, showing two center sections, a vertical column with BORIZER in position and a horizontal wing base with angular column for BORIZER mounting.



## It's HERE, at HEALD, right now!







WHETHER you call it "modular construction" or "building-block design," it's already an accomplished fact at Heald.

Recognizing that standardization of components for automated Borizing equipment can effect *substantial savings* in initial cost and job changeovers, Heald has designed and built standard center sections, wing bases, angular raising blocks, vertical columns and slide units which can be integrated to perform virtually any combination of roughing, semi-finishing and finishing operations. The Heald system of basic components is fully compatible with the proposed new INDUSTRY STANDARDS, which mark a major advance in the application of automated production equipment.

These standard components are ideally suited to the use of Heald BORIZERS, tooled to the requirements of any job. Changeovers are simply a matter of replacing or adding basic units, modifying work-holding equipment if required, and retooling the BORIZERS. Completely self-contained Heald Red Head BORIZERS, providing flexible control of feeds and speeds, simplify retooling and recycling, permitting the most versatile building-block arrangement obtainable.

Ask your Heald engineer to schedule a scale-model demonstration of the new modular design.

*It PAYS to come to Heald*

**THE HEALD MACHINE COMPANY**

Subsidiary of The Cincinnati Milling Machine Co.
**Worcester 6, Massachusetts**

Chicago . Cleveland . Dayton . Detroit . Indianapolis . Syracuse . New York

HEALD ®

**OCTOBER 1959**

**VOL. 66 No. 2**

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**Managing Editor:** CHARLES H. WICK
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EDGAR ALTHOLZ
RAYMOND H. SPIOTTA
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**Advertising Representatives**

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FRED W. SMITH
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LA MACHINE MODERNE
15, Rue Bleue, Paris-IX$^{e}$, France







# Machinery

***THE MONTHLY MAGAZINE OF ENGINEERING AND PRODUCTION IN THE MANUFACTURE OF METAL PRODUCTS***

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# HOW DO YOU MEASURE



# GROWTH?

Increased plant size is certainly one sure indication. The Landis Machine Company began operations in 1903 in a building having only 7600 square feet of floor space—represented by the color area.

Today, by comparison, the plant is a sprawling giant measuring nearly 400,000 square feet of floor space. In addition, the Landis plant in Canada includes 10,900 square feet. During the last 6 years we have continued to grow—through building 40,000 square feet of additional facilities in Waynesboro—the purchase of Maiden and Company, Ltd. in England—and an immediate expansion of 17,000 square feet at Maiden.

But mere physical size is not the only indication of growth. There are other indications, perhaps less tangible, but just as important. Maturity is one. Sincerity is another. And maybe the most important of all is Responsibility.

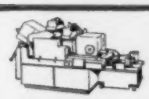
Landis is proud that it has "grown-up" not only in ways that show in figures and statistics, but also in ways that show in a friendly smile, a sincere hand-shake, and the willingness to accept the responsibility for customer satisfaction. These non-statistics are just as important to the people at Landis as graphs and charts; and, for over 50 years, they've proved to be important to our friends and customers.

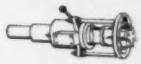
For assistance or information on any phase of threading production or equipment, call or write Landis—The World's Largest Manufacturer of Threading Equipment.

**LANDIS *Machine* COMPANY**
WAYNESBORO • PENNSYLVANIA
THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

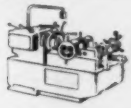

Thread Rolling Machines


Thread Rolling Tools


Centerless Thread Grinding Machines

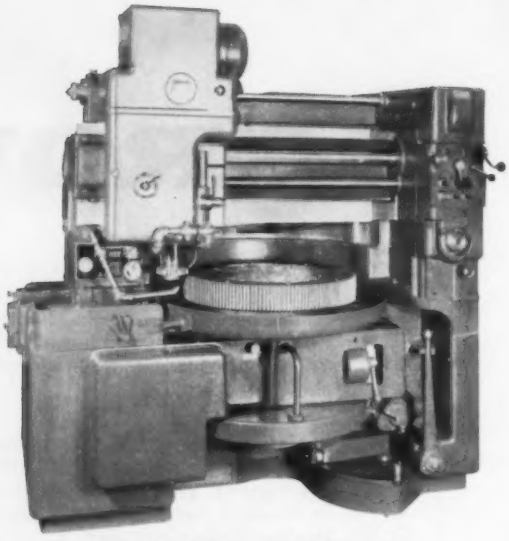

Taps—Collapsible & Solid Adjustable


Die Heads—Rotary & Stationary


Threading Machines

556C

# SHAPE IT, HOB IT, OR GRIND IT! ONLY FELLOWS OFFERS ALL 3 MACHINES!



Fellows Gear Shapers... up to 120" capacity



Pfauter Gear Hobbers... up to 120" capacity




No. 12 Fellows-Reishauer Gear Grinder... up to 12" capacity

WHATEVER YOU NEED for modern gear productivity, Fellows has the equipment to keep you in the competition! In addition to Gear Shapers, and all other Fellows equipment from cutters to inspection instruments, Fellows now sells the No. 12 Fellows-Reishauer Gear Grinding Machine and the complete line of world-famous Pfauter Gear Hobbers! Fellows Gear Shapers and Pfauter Gear Hobbers provide outstanding accuracy and high production speeds, on short runs as well as long runs, for a wide range of gears up to 120″ P.D. On all but the larger units, a wide range of attachments is available for semi-automatic or fully automatic operation. Runout tolerances measured in tenths, produced at production line speeds, are the special province of the No. 12 Fellows-Reishauer Gear Grinding Machine. Simple, fast set-up permits economical grinding of single gears as well as long runs in sizes up to 12″ O.D. Ask your Fellows Representative about the complete line of gear production and inspection equipment. Just write or call any office of The Fellows Gear Shaper Company, 78 River Street, Springfield, Vermont. Branch Offices: 1048 N. Woodward Ave., Royal Oak, Michigan.; 150 W. Pleasant Ave., Maywood, New Jersey; 5835 W. North Ave., Chicago 39, Illinois; 6214 W. Manchester Ave., Los Angeles 45, California.

# FELLOWS GEAR PRODUCTION EQUIPMENT

THE PRECISION LINE



For more data, circle this page number on inquiry card

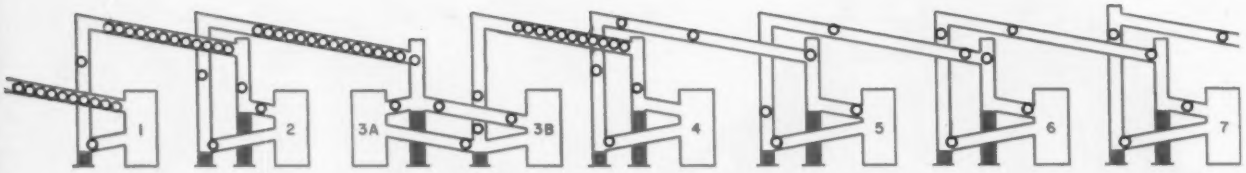
# CINCINNATI
## Grinding Machine Division

## . . . AUTOMATES PISTON RELIEF GRINDING to with established production line

Modern automotive pistons are slightly elliptical on the skirt diameter, requiring special precision grinding equipment and a high degree of cost-reducing automation. Cincinnati's Grinding Machine Division solved these problems by designing and building compact, self-contained production machines completely equipped in every way including grinding wheels, and ready to install in an established production line.

Feature-advantages include: automatic loading and unloading equipment, synchronized with the automatic grinding cycle; automatic truing; automatic sizing. And the biggest advantage of all is Cincinnati's integration of performance factors, from the drawing board to application of the grinding wheel. Only Cincinnati gives you this completeness of responsibility.

## . . . BUILDS OPERATOR-CONTROLLED and COMPLETE

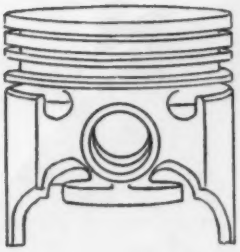


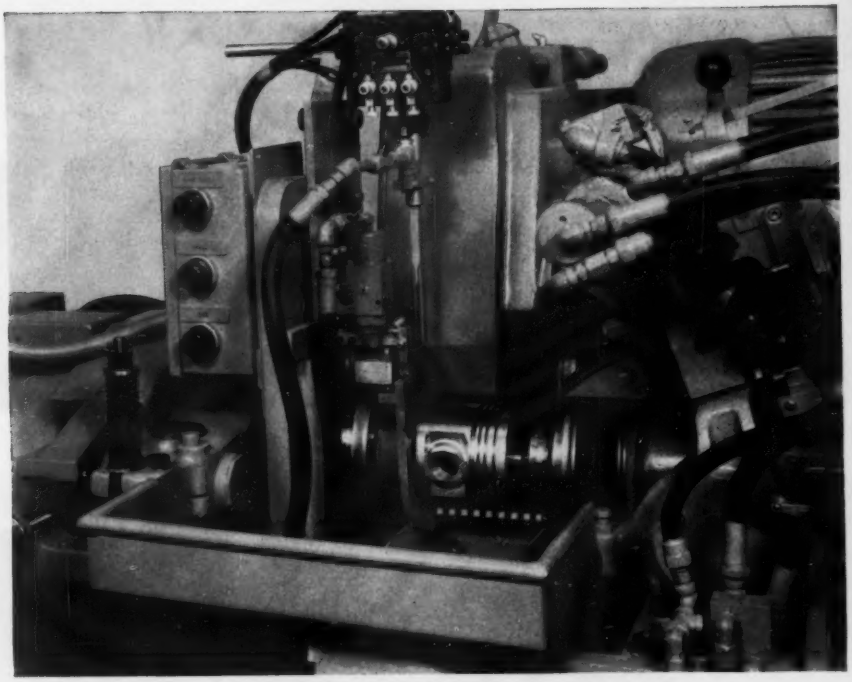

CINCINNATI

BUILDERS OF PRECISION GRINDING MACHINES: CENTERTYPE • CENTERLESS • MICRO-CENTRIC

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

**keep pace**



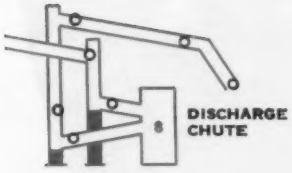


CINCINNATI FILMATIC Piston Relief Grinding Machine automatically grinds and sizes automotive piston. Production, 113 per hour.

FILMATIC

**MACHINES**

PRECISION GRINDING LINES




Operator-controlled CINCINNATI FILMATIC Grinding Machines are well known for their dependability and low-cost productivity. From the several types of these machines have evolved innumerable possibilities for precision grinding lines tailored to your requirements. The example diagramed here shows what can be done. It is an independent unit system, developed to grind five sizes of anti-friction bearing cones with a diameter range of 2 to 1. In all there are seven grinding and one polishing operation. Incorporated in the line are automatic sizing with feedback controls, automatic washing and demagnetizing, and a banking arrangement to take care of variations in production.

Cincinnati's outstanding degree of integration in supplying the complete equipment, including grinding wheels and electro-hydraulic and gaging equipment, is assurance of complete satisfaction with any machine or production line built by Cincinnati. May we give you more information?

• ROLL • CHUCKING • CENTERLESS LAPPING

CINCINNATI
GRINDING MACHINE DIVISION




For more data, circle this page number on inquiry card

# LANDIS micro



# feed

## for grinding to your closest tolerances...automatically

MICROFEED, a new precision wheel feed, is the biggest news in cylindrical grinding today. MICROFEED, on a new Landis grinder, assures precision to extremely close tolerances on a production basis.

This radically new wheel feed automatically cancels all variables which affect precision grinder feed systems. On piece after piece MICROFEED repeats its action with unerring accuracy.




# LANDIS

**precision grinders**

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

# U.S. Press Room Equipment and F.P.P. full profit potential

U. S. Press Room Equipment is designed for "F.P.P." — to help make press operations more profitable for you . . . to give to each press maximum flexibility and efficiency.

In many cases, press room productivity depends upon the flexibility of your equipment. The wider the range of material your presses can handle, the more productive and profitable they can be. When you combine this wider range of production with increased efficiency, you are approaching a production standard ideal for press rooms.

It is this standard — which has as its aim the realization of Full Press Room Profit for you — that dictates the manufacture and performance of every piece of U. S. Press Room Equipment.

For example, U. S. Slide Feeds are precision built units for the accurate feeding of coil stock into punch presses. They are adaptable to the feeding of one or more separate strips of wire or flat stock, either of regular or *irregular cross section*.

U. S. Flat Stock Straighteners and Two-Way Wire Straighteners are perfect complements to U. S. Slide Feeds. When teamed together they guarantee accuracy and contribute to prolonged die life.

***Write today for U. S. Bulletin No. 85M and learn how you can obtain maximum flexibility and efficiency for your present Press Room equipment—to give you your "F.P.P."***



**Some typical stock cross-sections readily accommodated by U. S. Slide Feeds.**

PRODUCTS

## U. S. TOOL COMPANY, INC.

**AMPERE *(EAST ORANGE)* NEW JERSEY**

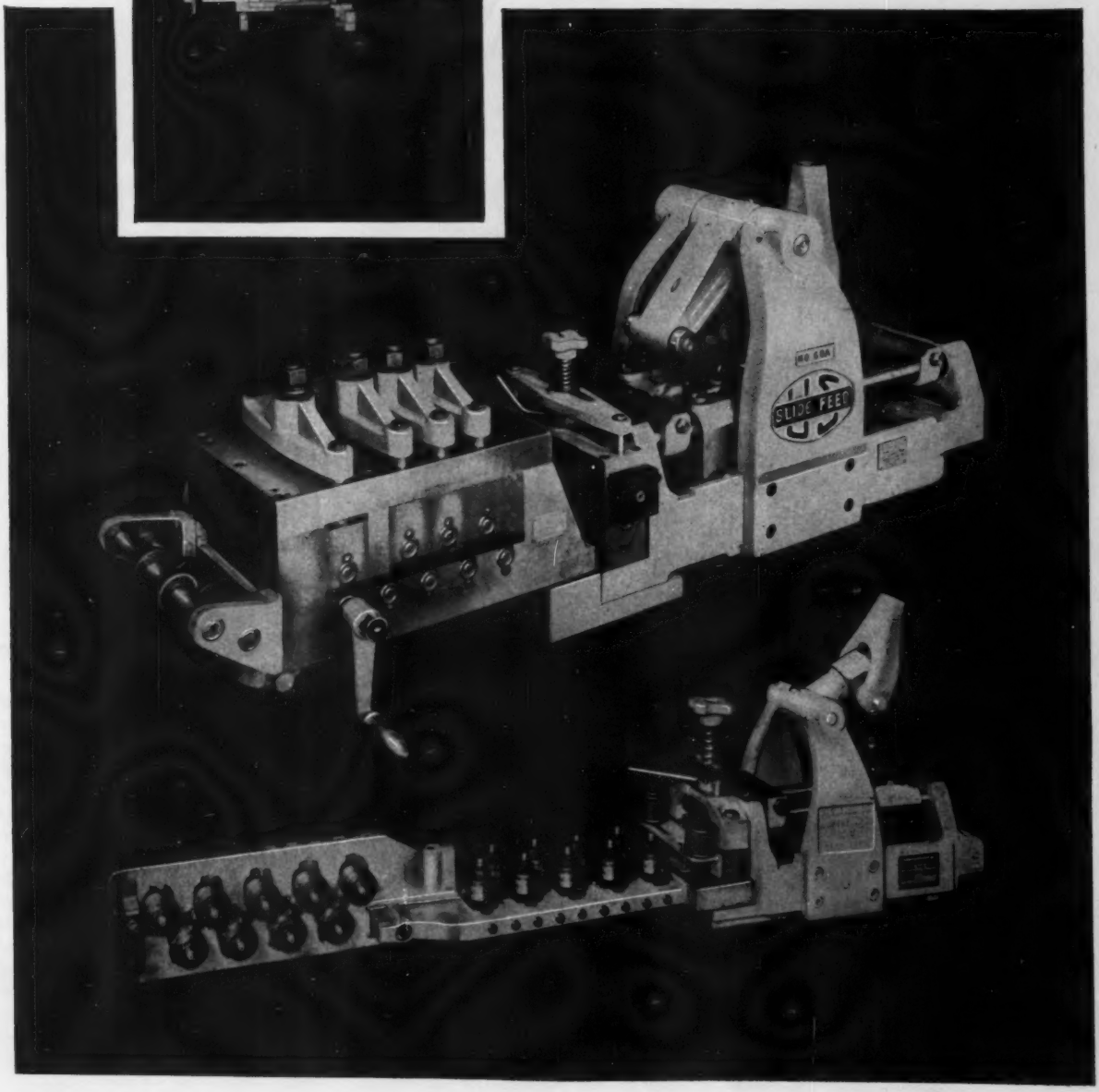
**U. S. Multi-Slides® • U. S. Multi-Millers® • U. S. Automatic Press Room Equipment • U. S. Die Sets and Accessories**



At left: **SF-1 U. S. Slide Feed with SS-07 Plain Stock Straightener mounted on conventional OBI press.**

Center illustration: **SF-68A U. S. Slide Feed with SS-27 Plain Stock Straightener. Maximum width capacity 6"— feed length adjustable up to 8".**

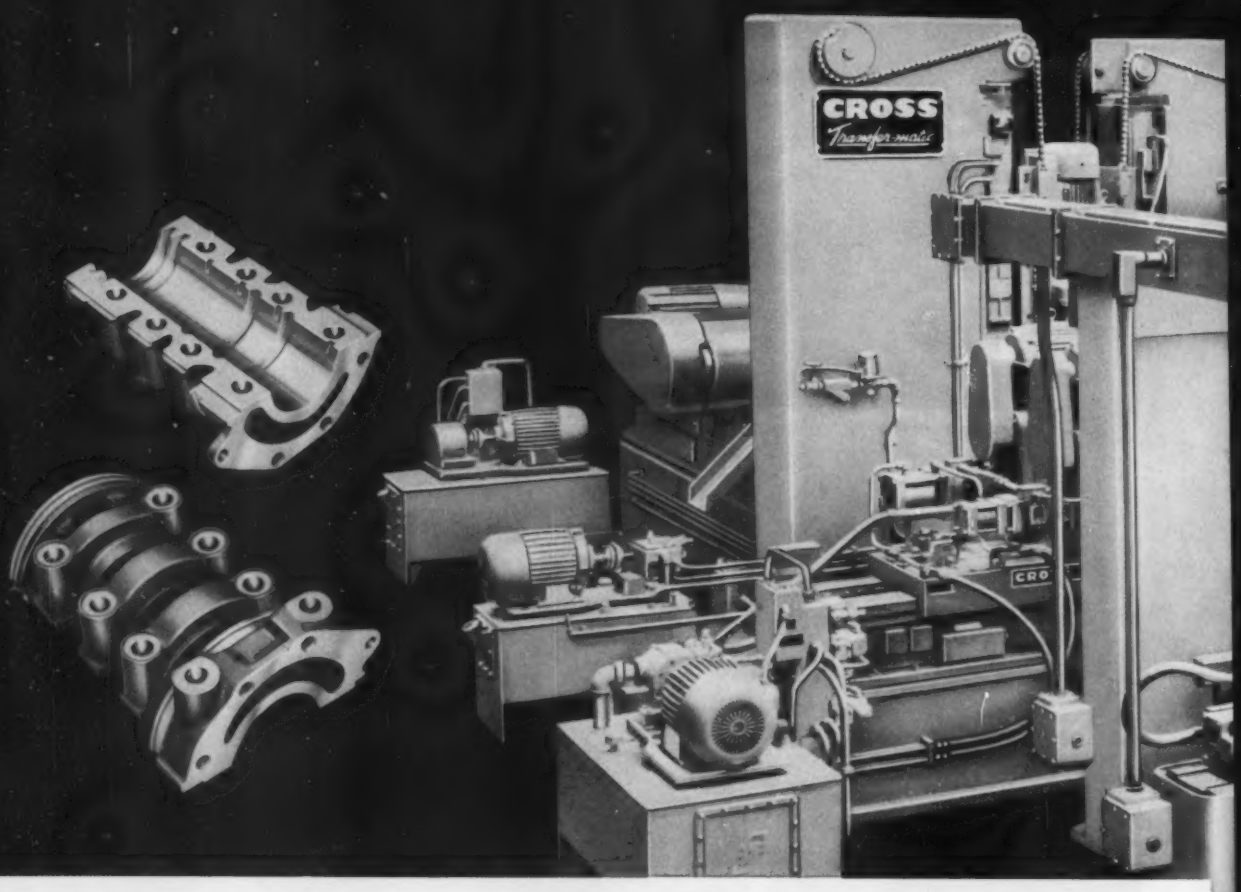
Lower illustration: **SF-O U. S. Slide Feed with Two-Way Wire Straightener (with nine rolls in each plane).**






For more data, circle this page number on inquiry card

# A New Approach For Processing Crankshaft Bearing Caps




This Cross Transfer-Matic, built for an European automotive company, provides an entirely new approach to machining crankshaft bearing caps. Capacity of the 30 station machine is 109 sets (436 pieces) per hour at 100% efficiency.

The parts, cast in clusters of four, are broached in preparation for the operations performed by the Transfer-Matic. Unlike American designs, the No. 1 and 4 caps require felt seal grooves and the No. 1 cap has a pattern of four holes in the end for mounting a fan belt cover.

## New Methods

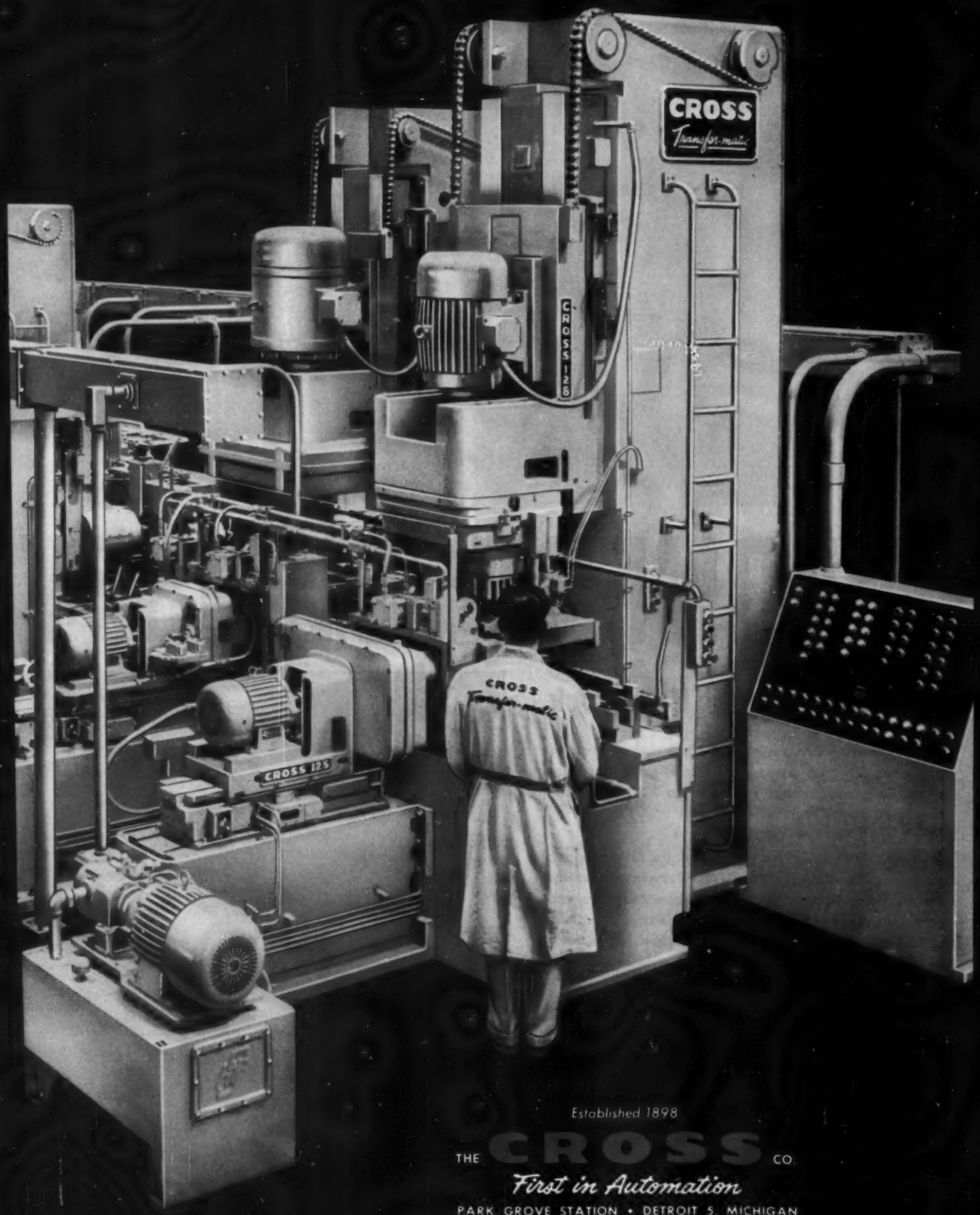
The clusters are indexed by a lift and carry transfer mechanism with the crankshaft axis at right angles to the transfer movement. The felt seal grooves are machined by standard cross-facing heads mounted on horizontal positioning units. The fan belt cover hole operations are also performed horizontally. The bolt holes, bearing lock notches, oil slinger grooves and the milling of a lug on the No. 1 bearing cap are all machined vertically.

## New Sawing Unit and Fixture

At the very end of the machine, the clusters are shuttled into a special sawing fixture where they are cut into individual pieces and ejected. The fixture, a new design, holds the parts with the joint face at a 40° angle. This arrangement permits the chips to fall free of the clamping mechanism and substantially reduces the overhang of the sawing cutters. During the sawing operation, locating pins are inserted in all of the bearing cap bolt holes to provide maximum rigidity and to prevent pinching of the saws as they withdraw from the work.

The machine is constructed to JIC Standards, has complete interchangeability of all standard and special parts, and is constructed out of standard Cross building blocks for optimum flexibility. A Cross Machine Control Unit equipped with Toolometers programs tool changes to reduce machine downtime. All tools are pre-set in standard Cross tool setting fixtures.

*Another Automation First by Cross*




Established 1898

THE CROSS CO.

*First in Automation*

PARK GROVE STATION • DETROIT 5, MICHIGAN

# NEW

# WARNER & SWASEY

## Unique, Automatic Headstock

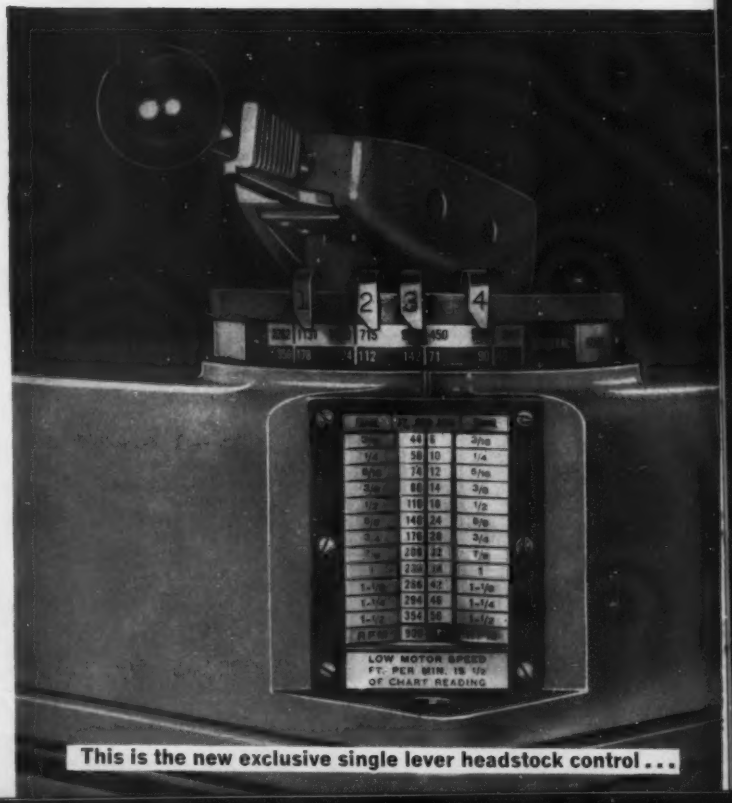
**More Speeds – Greater Range** –The new eight-speed headstock (16 with a two-speed motor) gives you more speeds in a wider range – from 45 to 2262 rpm – for maximum metal removal efficiency.

**Instant Speed Changes** throughout the full range are made possible through exclusive, Warner & Swasey designed direct-acting hydraulic clutches (which never need adjustment) in combination with a constant mesh, helical gear train. Time loss for gear shifting in conventional headstock gear trains is eliminated.

**Full Power** is always available at the spindle nose by the higher-powered, direct-mounted motor. Direct mounting also eliminates motor-drive maintenance problems.

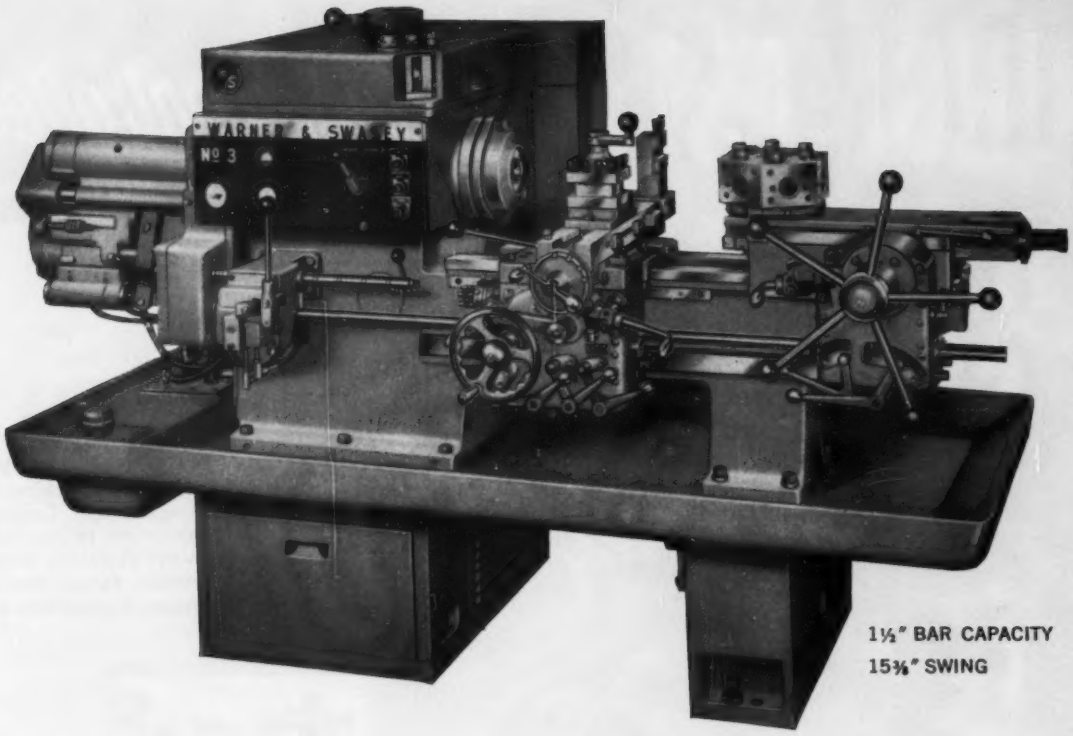
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**New, Rugged Bar Feed and Collet Chuck** are hydraulically operated with single-lever control for easy, fast handling. The wider base and rigid construction of the bar feed permits greater accuracy and smoother work finishes on high-speed, heavy-duty work.



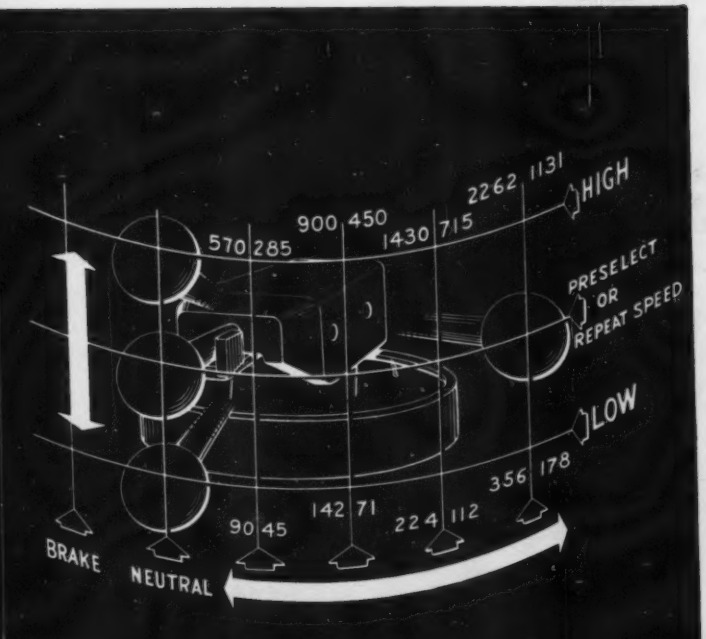

This is the new exclusive single lever headstock control . . .

For more data, circle this page number on inquiry card




1½" BAR CAPACITY
15⅜" SWING

# No.3 ram type turret lathe




This is how easy it is to operate

## Exclusive, Single Lever Preselector and Speed Control

Control of spindle speeds is now an easy one-hand operation on the new No. 3! Preselection of speeds, speed change, brake and neutral—all are obtained with the same lever!

**No fumbling for speeds**... no gear shifting. Just rotate the handle to preselect; move it up or down to engage new speed instantly.

**No figuring**... the direct reading preselector dial tells you the surface speed for each diameter and rpm.

**No remembering** (or forgetting)... the preselector drum lets you set up the sequence of cuts; numbered clips tell you where to find the speeds and their order of use.

Neutral (free spindle) and Brake are selected by rotating lever to the left.

Forward and Reverse are controlled by a switch lever on front of headstock.

For free brochure write Warner & Swasey Company, Cleveland 3, Ohio.

**You can produce it better, faster, for less... with a WARNER & SWASEY**

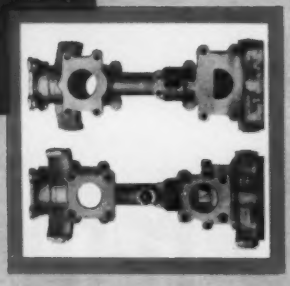
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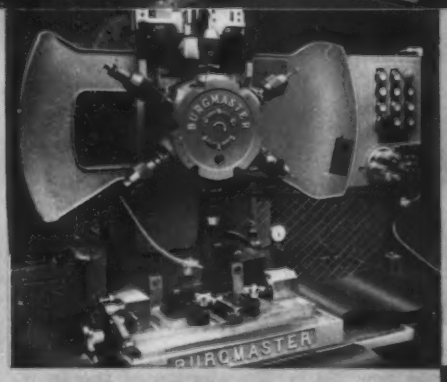
*Stainless Steel Valve Body*

# BURGMASTER *tape controlled*



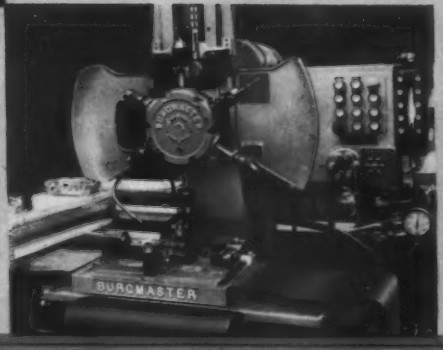
**#347 Stainless Steel Valve Bodies now machined on Automatic Tape Controlled Burgmasters to far better than the required ±.002" tolerances. Former time was 2.7 hours. Present time is ½ hour.**






**1st operation showing the simple quick clamping fixture, and tooling required to perform 32 precision drilling and c'boring operations.**

**2nd operation showing simple Fixture and tooling used to perform 27 drilling and reaming operations.**




**World's Largest Builder of Turret Drilling Machines**



"O" Manual Power Index ¼" Capacity



1C Manual Power Index ⅜" Capacity



2B Manual Power Index ⅜" Capacity



2BF Flange Mounted Power Index ⅜" Capacity



2BH Automatic Hydraulic ¾" Capacity



3BH Automatic Hydraulic 1½" Capacity



2BR Ram Type Radial Drill ⅜" Capacity



2BHT-3BHT Automatic Tape Controlled ¾" and 1½" Capacity

*Production Increased 440% with...*

# 6 SPINDLE TURRET DRILL

**(at Standard-Thomson Corp., Waltham, Mass.)**

Two Burgmaster G. E. Tape Controlled 6 Spindle Turret Drilling Machines used for machining #347 Stainless Steel Valve Bodies at Standard-Thomson Corporation, Clifford Mfg. Co. Division, Waltham, Mass. have increased production 440% as compared to a multiple drilling set-up using dowel location holding fixtures. The valve jobs are now machined in 2 set-ups (one per machine) and a total of 59 operations including drilling, c'boring and reaming are automatically performed in ½ hour rather than the former time of 2.7 hours.

The machines were purchased expressly for this job although they will also be used for other work. "The repetition of controls has been perfect, and dimensions are held far beyond the required tolerance."

**MAXIMUM FLEXIBLE AUTOMATION** is obtained from Burgmaster 6 and 8 spindle Turret Drilling, Tapping and Boring machines because they can be quickly and economically set up to produce a large variety of parts using standard tools and simple work holding clamps.

The standard adjustable Burgmaster controls are maintained...including pre-selective spindle speeds, infinitely variable pre-selective feeds, slective rapid approach and return, skip indexing, precision depth control, and simple manual controls for set-up. The G. E. numerical system controls all machine functions, selects spindles in any sequence, automatically positions the table on two axes, clamps the table while machining operations are performed, and controls coolant. Up to 6 or 8 different operations can be performed at any command position without moving the table, or as many cycles using one tool as desired, without indexing. All operations are carried out at their most efficient rate for high finish, precision, speed, and longest tool life. As a result one man can operate two or more machines on many jobs, or by attaching two tapes together one part can be machined on one end of the table while work is being set up on the other to effect constant machine operation.

Whether your work is small lots or high production you can obtain exceptional savings and production increases with Burgmaster Tape Controlled Turret Drills. Our representatives will be glad to discuss this possibility on your work with you, at no obligation. Just call.

## JOB FACTS

**Machines:** Two Burgmaster Tape Controlled Turret Drills.
**Parts:** Valve Bodies #347 Stainless Steel
**Lot Size:** 50
**Holding Fixtures:** Simple quick acting clamps
**Operations:** 59 — C'Drilling, Drilling, C'Boring and Reaming
**Accuracy:** ±.002" required
**Former Time:** 1st operation — 1.2 hours
2nd operation — 1.5 hours
Total: 2.7 hours
**Present Time:** 1st operation — .17 hours
2nd operation — .33 hours
Total: .5 hours
**Savings:** 2.2 hours
**Production Increase:** 440%
**Other Advantages:** Far better accuracy than required; repetition of controls has been perfect.

**Write for Bulletin describing Burgmaster 6 and 8 Spindle Tape Controlled Turret Drilling, Tapping, and Boring Machines. Thirty-minute 16mm sound film showing all Burgmaster Turret Drills in operation is available from any office without charge.**




**BURG TOOL**
MANUFACTURING COMPANY, INC.
15001 South Figueroa Street, Gardena, California
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Circle 16-17 Inquiry Card



**10" CUT IN 60 SECONDS**
with conventional dry cut, using single point carbide "throw-away" insert.

# A new cutting fluid that

## *with any single-point*

**Shell's experience in the last 3 years proves that Shell Dromus Oil E can give production increases of at least 25% with comparable cost savings.**

Incredible as this may seem, Dromus® Oil E alone accounts for these considerable production increases! And here's how simply Dromus E does it: Use Dromus Oil E (diluted with 20 parts water) at the correct cutting speed. Then, increase the feed rate by one-third and operate as before. You can get a 25% production increase . . . optimum conditions may show as high as 40% improvement!

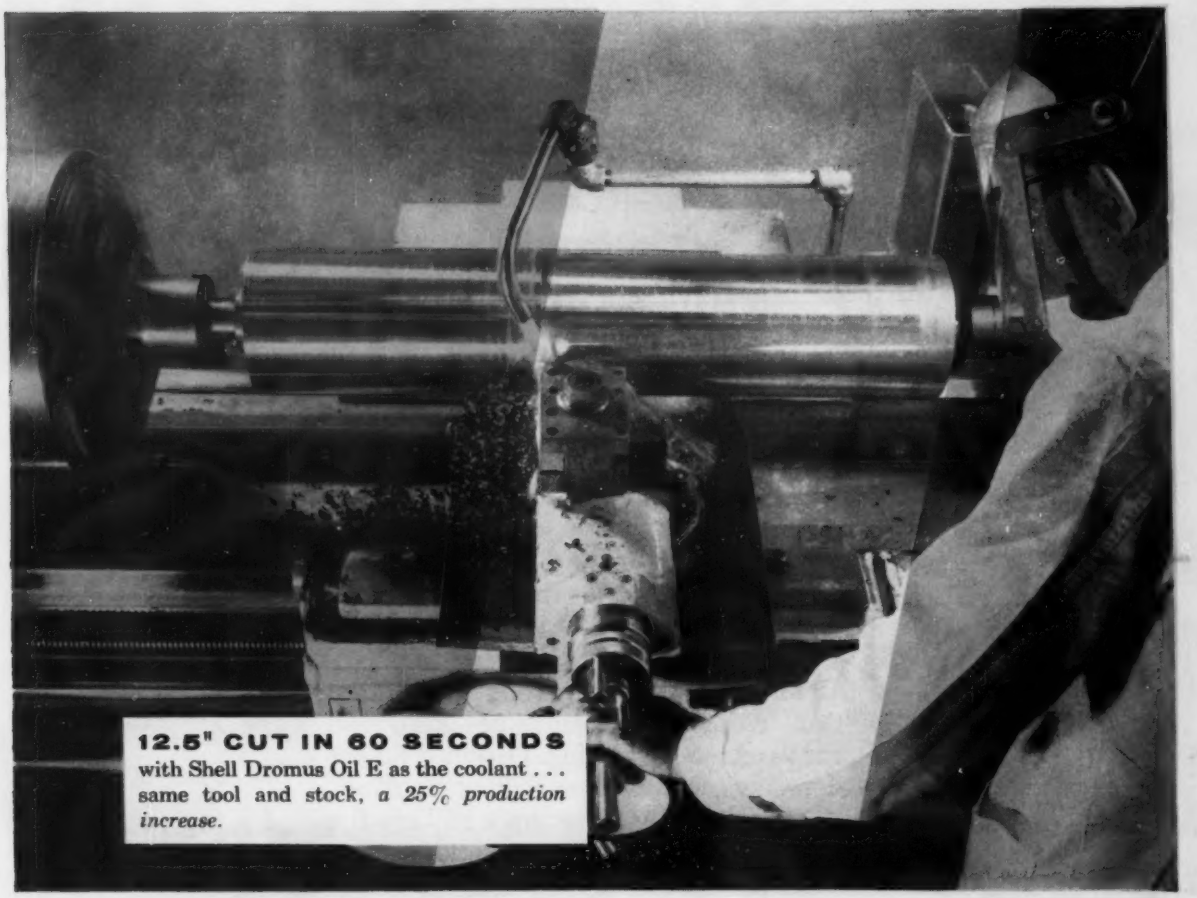
**Applies to wet or dry cutting.** Regardless of whether you're now cutting dry, or with emulsions or heavy-duty oils, this simple increase of feed applies.

**Applies to all milling, turret and automatic lathe set-ups.** This is an across-the-board production improvement. If the machine can stand the extra 25% feed, the rule applies to all milling and turning jobs!

**Applies to set-ups as they are** . . . no changes required. There isn't a single thing that has to be changed or adjusted . . . just the feed and provision for keeping the work wet with Dromus E.

**Shell Dromus Oil E offers these many other outstanding benefits too!**

1. Greater worker safety—chips are cool.
2. No fire hazard—Dromus E is nonflammable even after water evaporation.
3. Closer dimensional tolerances can be obtained—less heating of the work piece occurs.
4. Brighter surface finish is obtained.
5. Excellent protection against rust.




# permits 25% greater feed
(AT FULL SURFACE SPEED)

# *carbide "throw-away" insert*

Dromus Oil E is one of those products that comes up once in a generation. Rather than attempt to offer proof after proof of what this announcement offers, we simply invite you to let the Shell Industrial Products Representative show you what Dromus Oil E can do in *your* plant! Please write Shell Oil Company, 50 West 50th Street, New York 20, New York, or 100 Bush Street, San Francisco 6, California. In Canada: Shell Oil Company of Canada, Limited, 505 University Avenue, Toronto 2, Ontario.

## SHELL DROMUS OIL E

THE NEW COOLANT FOR METALWORKING

SHELL



For more data, circle this page number on inquiry card

# ARMSTRONG



## SET-UP AND HOLD-DOWN TOOLS

ARMSTRONG Set-up and Hold-down Tools reduce setting-up time—keep men and machines producing. Designed for use on planers, drill presses, milling machines, etc., they hold work securely and rigidly, and thereby reduce spoilage and prevent costly accidents.

Your local Armstrong Distributor carries ARMSTRONG Set-up and Hold-down Tools in stock in sizes for every operation. Stop haphazard setting-up methods. Provide each of your machines with a full complement of ARMSTRONG Set-up and Hold-down Tools.

*Write for Circular*

Buy ARMSTRONG TOOLS from your Industrial Distributor

T-SLOT CLAMP

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UNIVERSAL CLAMP

T-SLOT BOLTS AND NUTS

STEP BLOCK

STRAP CLAMPS

**ARMSTRONG BROS. TOOL CO.**

5216 W. Armstrong Ave. Chicago 46, U.S.A.

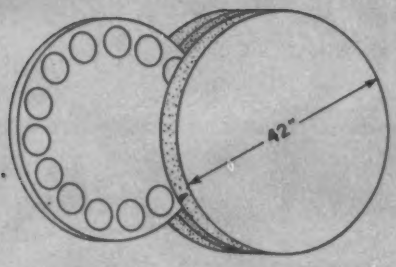
# new Gardner 2H40 precision disc grinder

*larger discs . . . more power . . . greater capacity*




40 hp drives
42″ discs

*New 2H40 Double Spindle Precision Disc Grinder*




Rotary work carrier is illustrated. 2H40 is also available with thru feed or gun type fixturing.

**Greater accuracy**—increased travel between larger discs improves flatness and parallelism.

**Higher productivity**—as much as 75% greater for parts over 6″ in diameter compared to 30″ disc grinder.

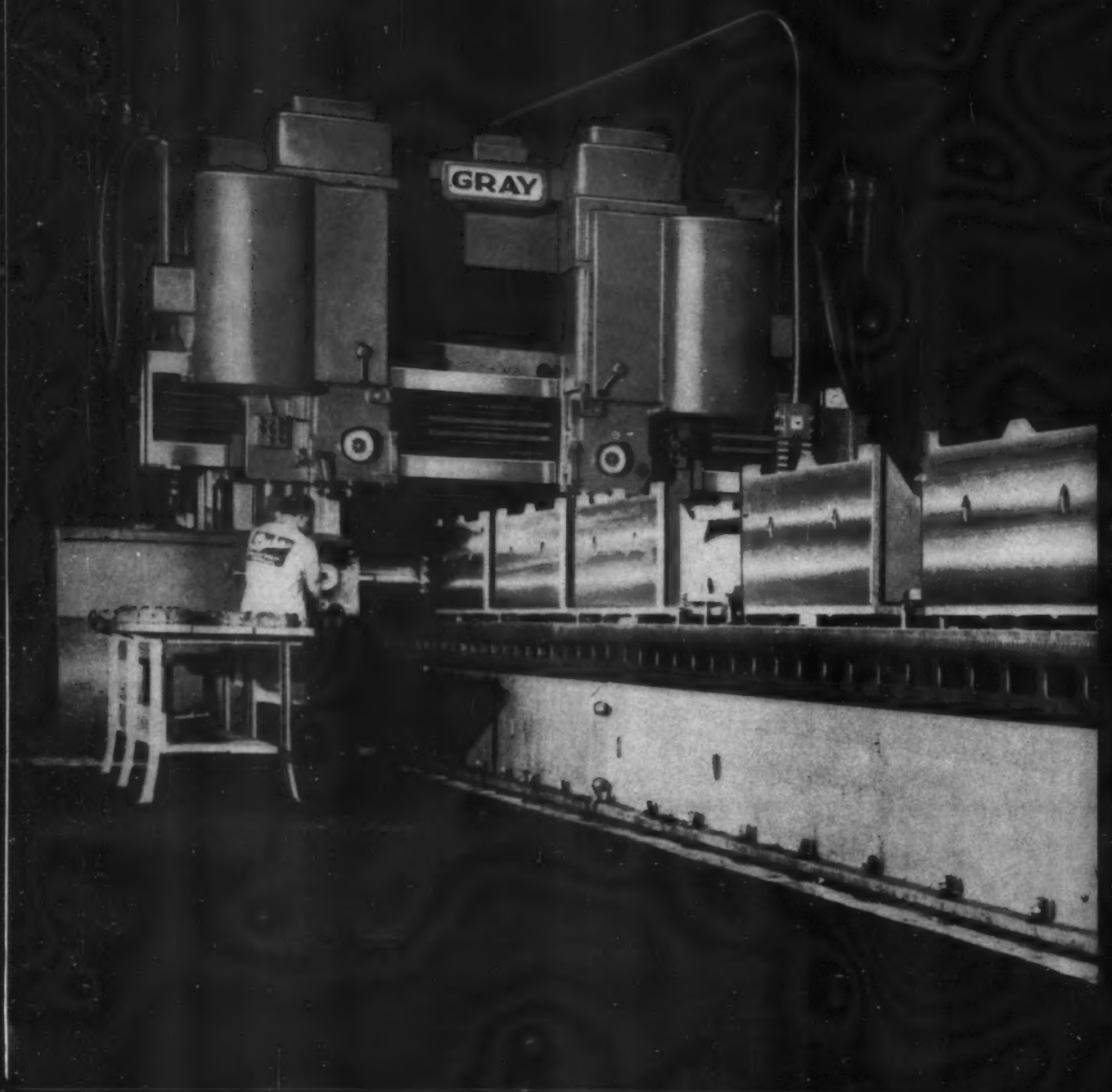
surface grinds **TWO** sides parallel in **ONE** operation

# GARDNER

precision disc grinders

BELOIT, WISCONSIN

# progress starts

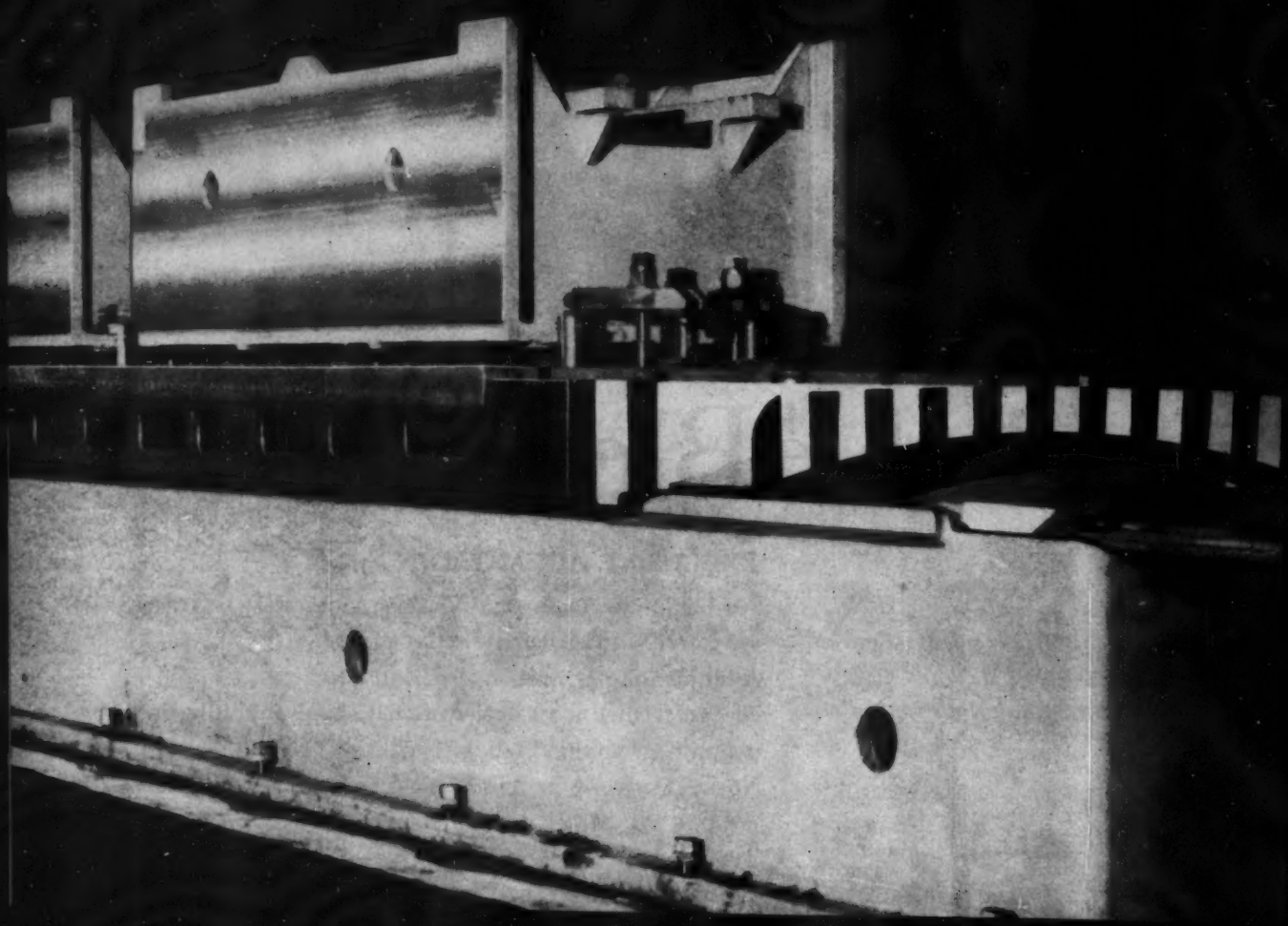


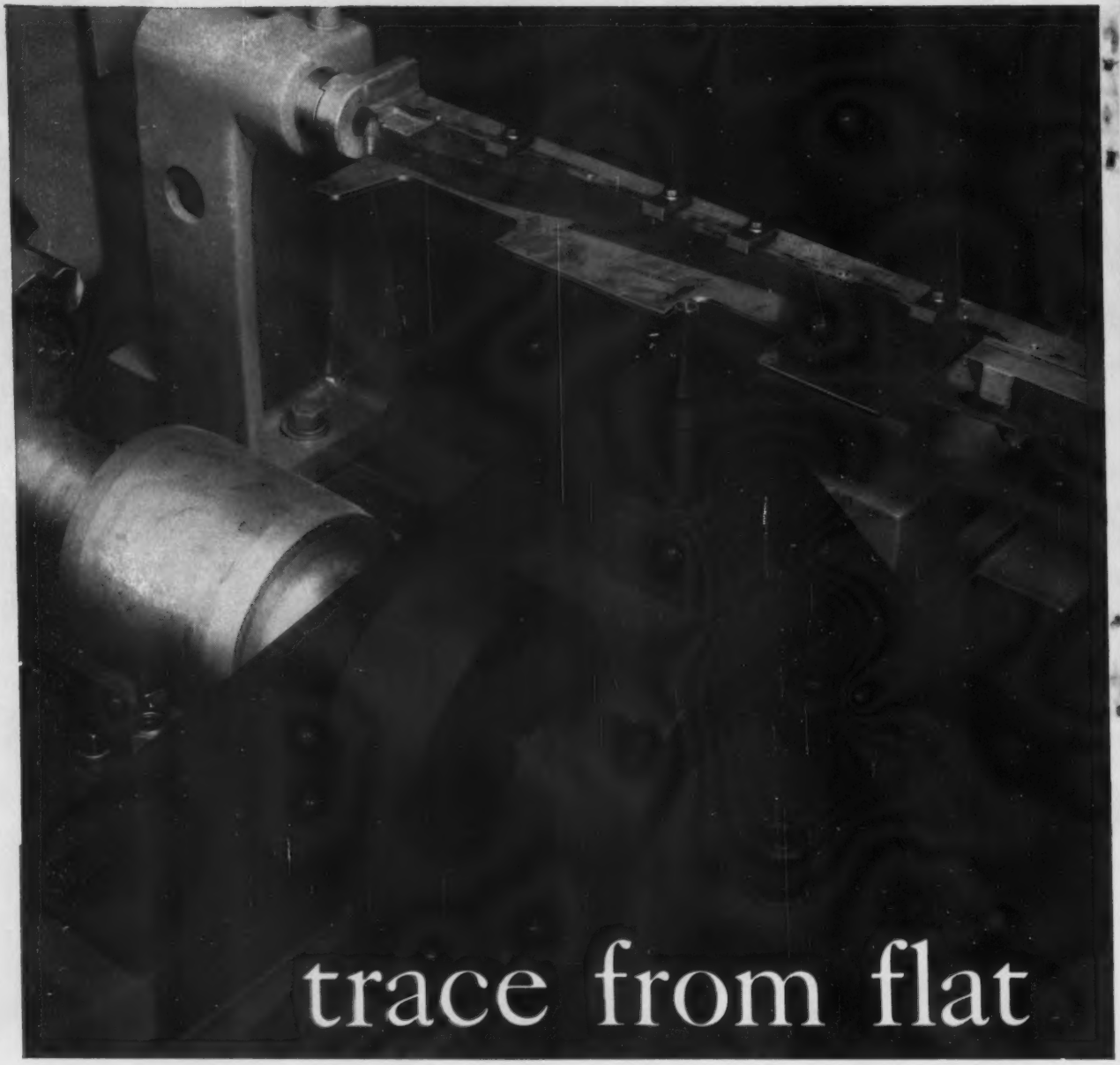
# on a GRAY

What you see being milled on this big 105 foot long Gray, are transfer machine bases of the future... six at a time... automation production machines of Buhr Machine Tool Co., of Ann Arbor, Michigan. It's logical that this company, engaged in producing cost cutting, time saving equipment, should select a cost cutting, time saving Gray to do the job.

Gray unit head planer type millers dominate the field of modern heavy duty milling. This 66' x 66' x 50' giant can simultaneously deliver 300 H. P. to its four cutters. Duplex tables virtually eliminate idle time by permitting work set-up on one section, while work is being milled on the other section. Unusually simple control encourages maximum operator efficiency. All this, plus mirror smooth surfaces milled to precise tolerances maintain the Gray reputation for top quality the world over.

The G. A. GRAY Co., Cincinnati 7, Ohio





# trace from flat

# with LêBlond's new

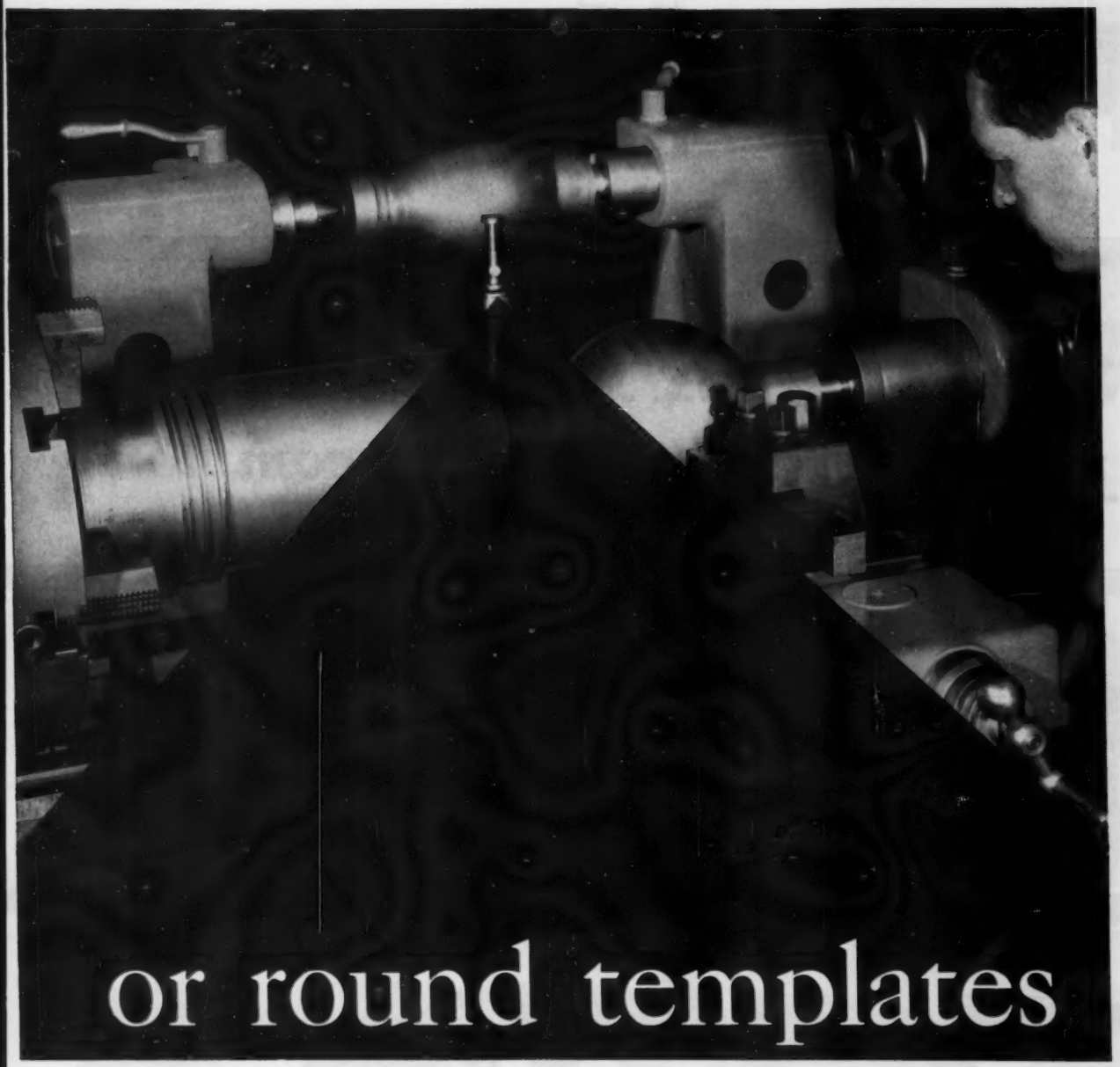
*available on 13", 16", 20", 25" and 32" Heavy Duty Lathes*
*16", 20", 25", 32" and 40" Standard Duty Lathes*

**EXCLUSIVE ADVANTAGES**

No loss of swing capacity (raises unnecessary). Tracer system allows full horsepower at tool.

All hydraulic controls conveniently located at apron—change from trace to conventional simply by adjusting two nuts at apron.

No overarms or other obstructions to loading templates—



# or round templates

# 90° Tracer

all components, including hydraulic pump and tank, integral with cross slide.

Positive mechanical linkage between stylus and tool slide —no strain on cross feed screw and nut.

Tolerance—.001" on diameter; .001" on shoulder length.

*Write today for descriptive bulletin.*

*. . . cut with confidence*

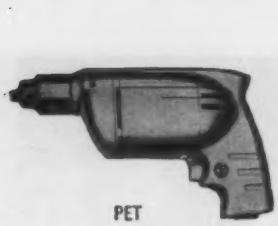
THE R. K. LEBLOND MACHINE TOOL COMPANY,
*Cincinnati 8, Ohio*

LeBLOND of Cincinnati

*World's Largest Builder of A Complete Line of Lathes.*



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# 33 GREAT MAKES

## *with ONE big feature in common–*



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# Jacobs CHUCKS















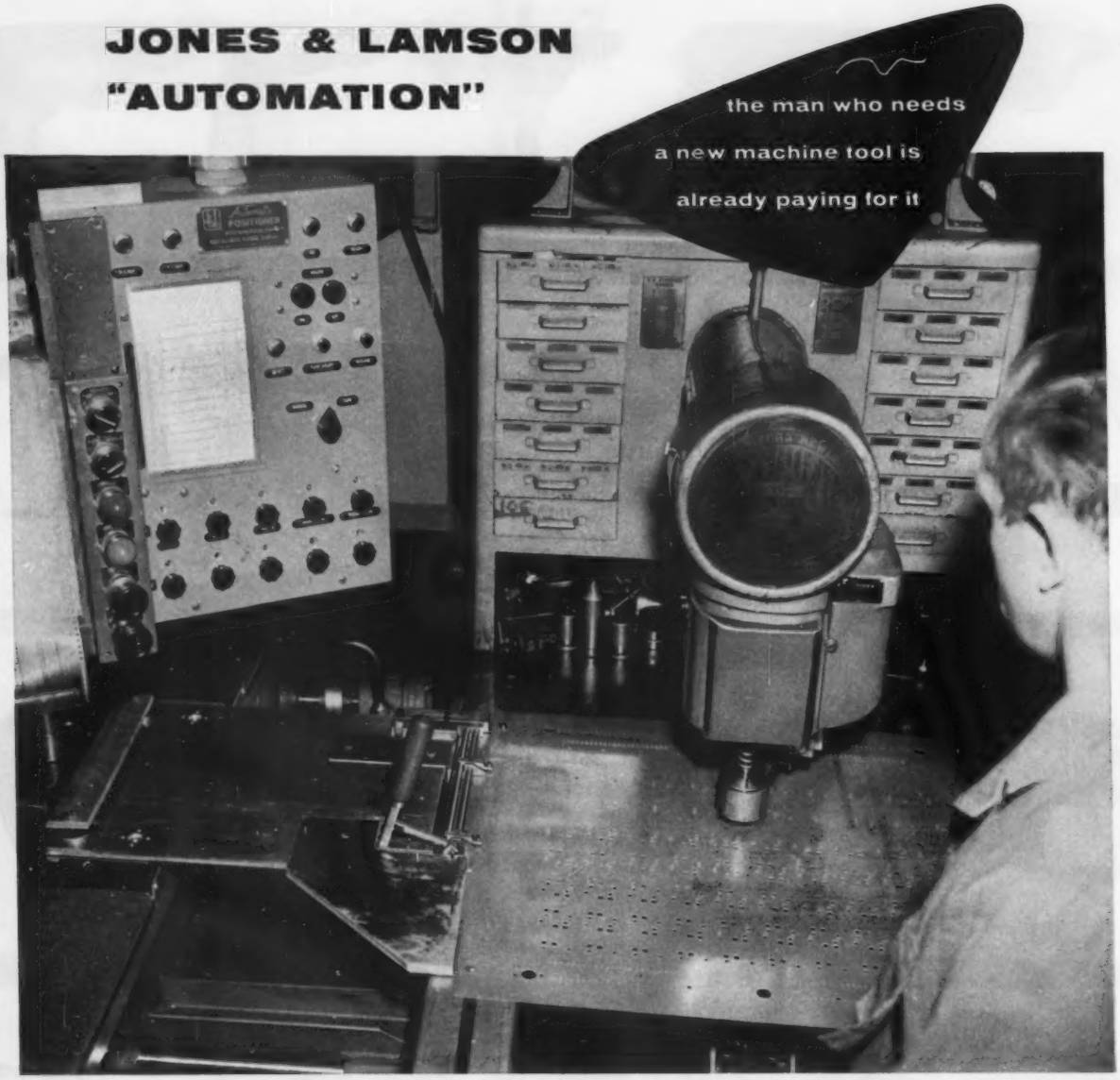

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INDUSTRIAL DISTRIBUTORS — SERVING INDUSTRY DYNAMICALLY — THE RIGHT HAND OF PRODUCTION

THE JACOBS MANUFACTURING COMPANY, WEST HARTFORD, CONNECTICUT

# JONES & LAMSON "AUTOMATION"




## This Tape Controlled Setup Punches 1483 holes – of 11 different sizes – in just 85 minutes

How's this for small lot automation? The problem is to produce 50 parts, each having 1483 holes of 11 different sizes. Hole location must be ±.002". Delivery — 2 weeks.

J & L's numerical control positioning table, applied to a standard punch press, does the job with minimum lead time, production time, and cost. Here's how:

The entire tape programming for this complicated part takes only 15 hrs. There are no fixtures, templates, or dogs to be made and set. No gang tooling to prepare. No appreciable setup time.

The operator simply inserts the prepared tape, locates the work piece and pushes a button. The positioning table is then automatically controlled in any pre-arranged, random pattern. Therefore there are only 11 tool changes for the 11 sizes of holes. And — this unit tells the operator when and what tool to change.

A completed part comes off the machine every 85 minutes. Changeover for other jobs is just a matter of changing tapes and tools.

Investigate how tape control can help increase the efficiency of *your* operation. Write to Jones & Lamson Machine Company, 512 Clinton Street, Springfield, Vermont.

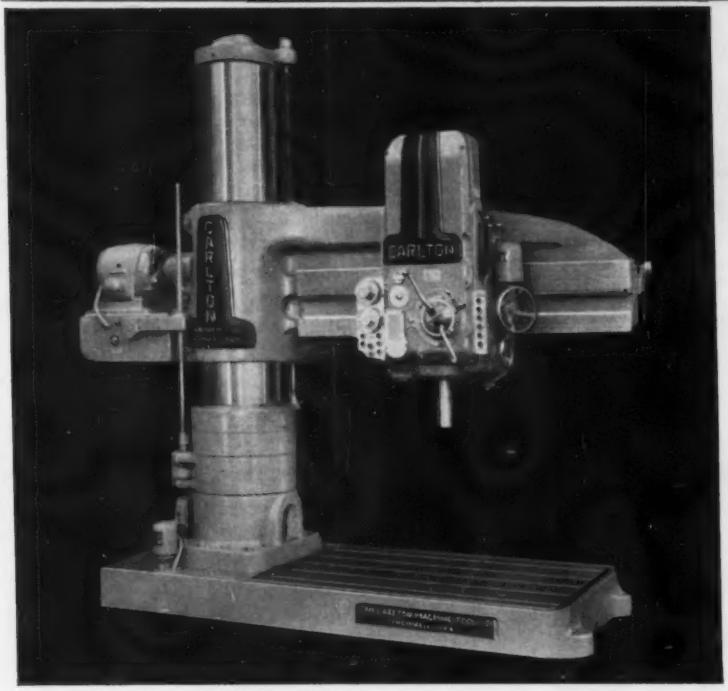
Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

| Model | Column diameters | Arm lengths | Speeds No. | Speeds Range | Feeds No. | Feeds Range | Motor recommended |
|---|---|---|---|---|---|---|---|
| 0A | 9" | 3'-4' | 9 | 20 to 1 | 4 | .008-.020 | 3-hp |
| 1A | 9"<br>11" | 3'-4'<br>3'-4'-5' | 12 | 25 to 1 | 6 | .006-.025 | 5-hp<br>5 or 7½-hp |
| 3A | 13"<br>15"<br>17" | 4'-5'<br>4'-5'-6'<br>5'-6'-7' | 36 | 100 to 1 | 18 | .004-.125* | 7½, 10, 15, 20 or 25-hp |
| 4A | 19" | 6'-7'-8' | 36 | 100 to 1 | 18 | .004-.125* | 15 to 40-hp |
| 5A | 22"<br>26" | 7' to 10'<br>8' to 12' | 36 | 100 to 1 | 18 | .004-.125* | 20 to 40-hp† |

*8, 11½, 14 and 18 threads per inch are standard, with various other combinations available.
†Driving motor larger than 40 hp can be used if desired.

# *Carlton . . . the modern design radial drill*

# 0A 1A 3A 4A 5A




Only at Carlton can you take your choice of

- 5 differe[redacted] of radial drills
- Column[redacted] to 26"; arm lengths from 3-ft. to 12-ft.
- 5 different types of speed-feed controls (3A, 4A and 5A models)

For the utmost in versatility, you can choose the Carlton Programming System that lets you pre-set speeds and feeds for a complete drilling sequence of 20 or more operations.

For production operations involving fewer and less complex drilling sequences you can select from among three speed-feed controls that help make the machine more productive: Pre-select, Power range Pre-select and Partial Pre-select.

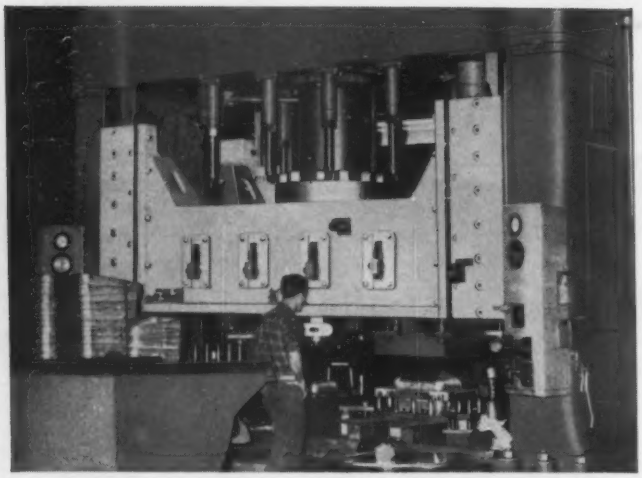
And in manual control, Carlton's simplified pushbutton control head is the most modern in design and easiest to operate.

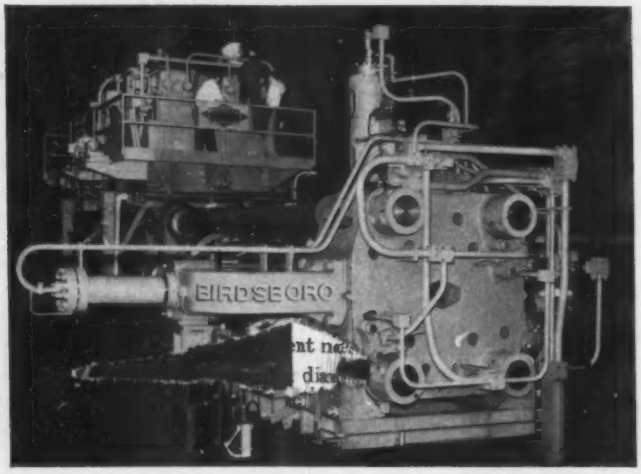
There's no compromising at Carlton . . . where you select the radial drill that fits your requirements exactly. Write today for bulletins describing the sizes you need. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

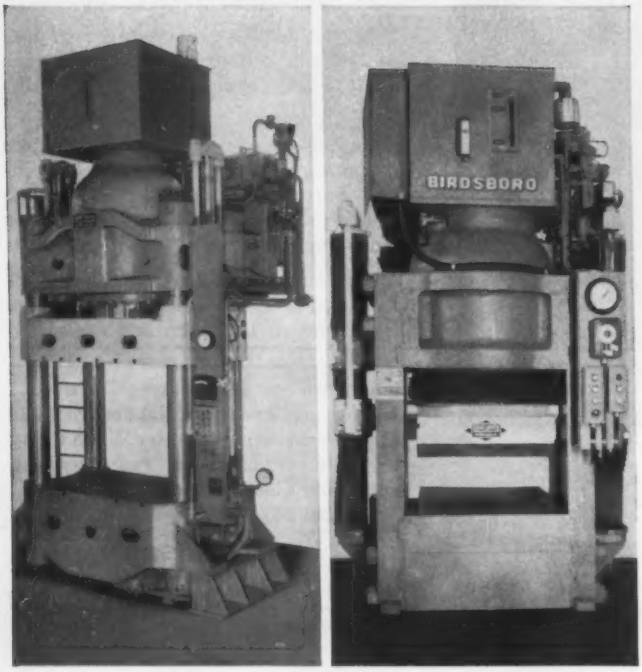
**Carlton** *Specialists in radial drills*



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# new

## Hydraulic Press design advances are produced consistently by BIRDSBORO experience

With any type of press job, Birdsboro has the engineering know-how and production experience to give you a customized job. From a wealth of background comes new design features in which Birdsboro engineers take pride. These are features that make possible new production savings in time and cost and insure product quality. A Birdsboro representative can bring you up to date on the latest developments. *Sales Department:* Reading, Pa., *Engineering Department and Plant:* Birdsboro, Pa., *District Office:* Pittsburgh, Pa.

BIRDSBORO HYDRAULIC

HP-33-58

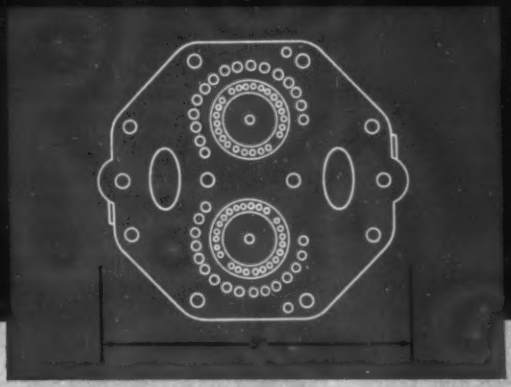
**BIRDSBORO**

STEEL FOUNDRY AND MACHINE CO.

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# Gardner engineered abrasive improves finish in lapping operation from 12 to 4 RMS





*. . . manufacturer standardizes on Gardner discs after competitive trial*

Workpiece: Cast iron valve plate—.282" thick
Stock removal: . . . . . .002" overall
Finish: . . . . . Former Disc—12 Micro finish
Gardner Disc—4 Micro finish
Gardner disc: . . 500 grain silicon carbide deep corrugated Yellow-Rim® disc

***Write today for your copy of Gardner's Abrasive Catalog.***

**GARDNER**
**abrasive discs**
BELOIT, WISCONSIN



# WELDING TIME ON MISSILE BEAMS CUT IN HALF

"I'VE got something here I'd like to demonstrate for you." George Giangrande, a Lincoln welding engineer, was talking to Mr. S. Wagner, Plant Manager of the Couse Manufacturing Company of Newark, New Jersey.

On a welding application, he had spotted at a previous visit to their plant, Mr. Giangrande proceeded to show Mr. Wagner and Mr. William Wier, the Welding Foreman, how a change in the type of electrode used and the resulting increase in speed would improve the welds, yet cut time and welding costs.

As a result, Couse Manufacturing is now welding missile beams in 45 minutes where it formerly required 90 minutes. The electrode which made this possible is Lincoln Jetweld "1".

"Because of the savings Giangrande was able to realize for us on the missile beams," stated Mr. Wier, "we've asked him to survey our other welding operations. Since then, we've changed procedures for welding on trailer bodies which are now giving us considerable savings through faster welding and less cleaning required."

Helping customers cut costs is an everyday occurrence for the Lincoln man. Because he is a welding engineer, he appraises each welding operation in light of its own particular requirement. He then demonstrates the procedures and *proves* the savings in actual production.

What George Giangrande did for Couse Manufacturing, your Lincoln man can do for you. It's his business to save you money—why don't you give him a ring?

*The World's Largest Manufacturer of Arc Welding Equipment*

LINCOLN

**THE LINCOLN ELECTRIC COMPANY · DEPT. 1236 · CLEVELAND 17, OHIO**

# PRODUCTION POINTERS from GISHOLT

More cost-cutting IDEAS— to help you

## HOW BARBER-COLMAN ELIMINATES "GUESSWORK" ON MACHINE REPLACEMENT

### Two-point program determines need, turns future losses into profits

With careful planning, as shown here, it is easy to discover profit leaks in old equipment before they become serious losses. Substantial savings and earnings result when replacement is timed right.

The 2-point program used by Barber-Colman Company, Rockford, Illinois, is a modification of the MAPI Formula. It pinpoints the most opportune time for action and verifies the purchase decision on actual work.

Here's how this plan works: Barber-Colman made a detailed study comparing a new Gisholt No. 5 Ram Type Turret Lathe and an old turret lathe on the basis of the coming year's work. Production rates and operating, maintenance and depreciation costs for each machine were analyzed on the Barber-Colman Standard Replacement Analysis Form.

These costs (including renovating) for the old machine indicated that immediate replacement with a new No. 5 would effect substantial savings in costs during the first year alone. The new Gisholt offered greater swing for a wider work range. Greater horsepower, higher speeds and a wider feed range would permit more efficient use of carbide, ceramic and cemented oxide tools.

Four months after purchase, a careful on-the-job analysis showed that the new Gisholt saved an average of 38% in production time on all parts.

Here's how this versatile Gisholt No. 5 allowed a 58% saving on a typical problem part—a 3-pound, 9" aluminum brake arm for a Barber-Colman textile machine. A face-plate fixture is used for locating, holding and driving. Drilling, forming multiple-face diameters, boring and reaming are handled from the hex turret. A single tool on the cross-slide square turret faces the boss at the end. Total f.t.f. time is 5.7 minutes as compared with 14.1 minutes on the old machine.

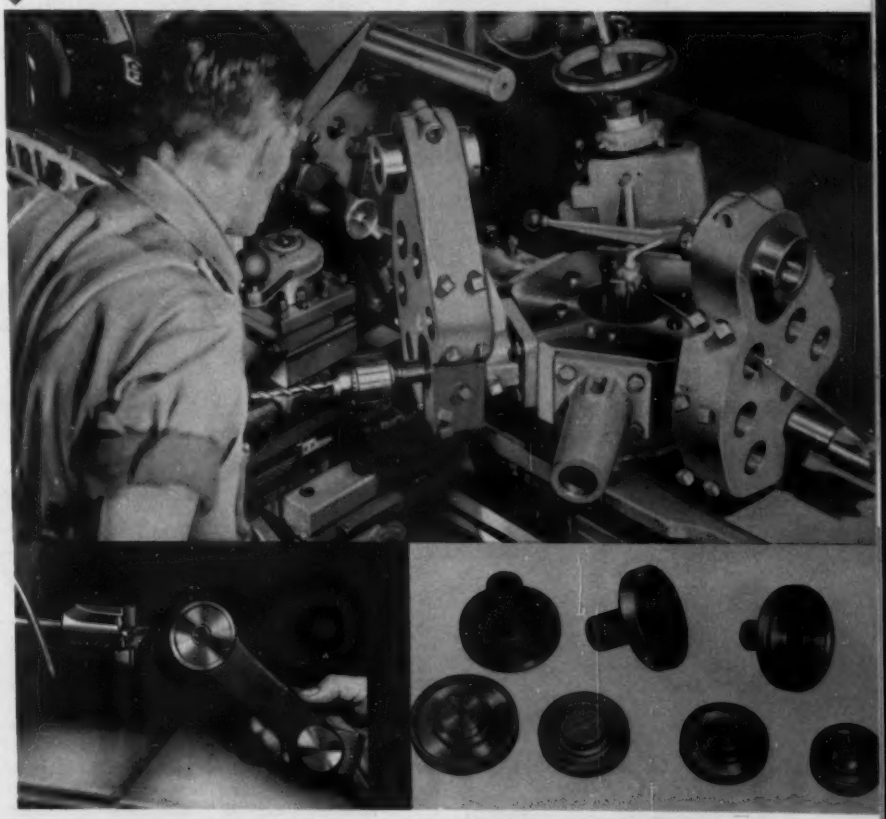
A few of the many parts handled in like manner with similar savings are shown at bottom. Change-over is fast and easy. The standard multiple and flanged toolholders remain in position on the hex turret. Only the standard boring bars, toolholders, stops, etc., are replaced or reset. The fine surface finishes obtained despite multiple-form cutting in a single pass speak for the rigidity and power of the Gisholt No. 5.

**Sound program pinpoints timely replacement. Time saved averages 38%.**

**For complete facts on No. 5 Ram write in No. 1749 on inquiry card.**



A typical example of the simple tooling allowed by the Gisholt MASTERLINE No. 5 Ram Type Turret Lathe. Many different parts are machined with the same basic setup. Production time on all parts averages 38% faster than obtained with the old machine.



The new Gisholt No. 5 machines this 3-pound cast aluminum brake arm 58% faster than the old machine. Multiple-diameter cutter completes face diameters in one pass for greater accuracy.

Typical workpieces. Top row: Rack and pinion gear blanks. Bottom: Brass disc holder valve assemblies. Fine surface finish on multiple-diameter faces obtained in a single pass demonstrates machine rigidity.

# DIESEL ENGINE MANUFACTURER CUTS HANDLING 50%, MACHINING 30% ON FLYWHEELS

## No. 24 with loader and back-boring attachment speeds work and improves accuracy

In high-production machining, even a few seconds saved per piece spell the difference between profit and loss. This setup gives you ideas on reducing handling and machining time, using single-spindle automatics.

The machine is a Gisholt MASTER-LINE No. 24 Automatic Chucking Lathe. Over 75 different sizes of cast iron flywheels are handled in lots of five to 100 pieces. Diameters range from 13″ to 24″, widths from 2″ to 6″.

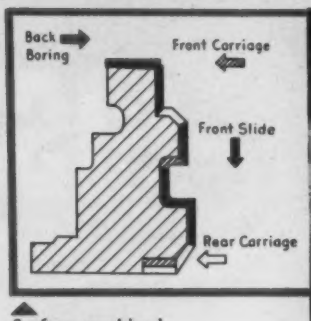
Proper machine selection and smart tooling solve three problems:

*Work Handling*—cut 50% by a headstock-mounted swinging loader.

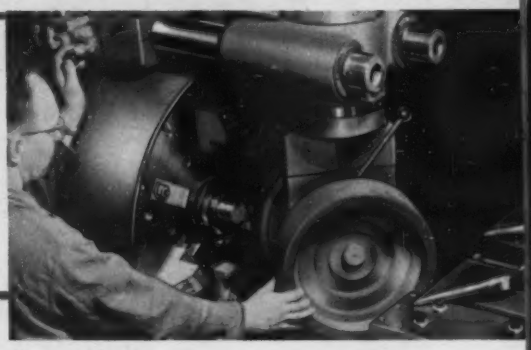
*Accuracy*—improved by a spindle-mounted back-boring attachment that combines boring with other cuts in a single chucking.

*Floor Space*—formerly, two machines were required. Now one No. 24 handles the entire range; provides the swing, rigidity and power to remove metal faster in 30% less time.

Here's how the part shown—14″ diameter, 3.880″ wide—is handled.




Surfaces machined in just 4.6 minutes, f.t.f. Arrows show carriage and slide movements.



Operator indexing work carrier. Note back-boring attachment in spindle bore.

While one part is being machined, another is positioned on a headstock-mounted swinging loader which has a 2-position indexing stock carrier. At cycle end, simple loader controls permit the following sequence: swing carrier parallel to machine center line; traverse in to pick up finished part; traverse out and hold while carrier is indexed 180°; traverse in and hold while new part is located and gripped in power-operated chuck; traverse out and swing carrier clear of tools. During automatic cycle the operator checks and removes the finished part and loads next workpiece.

The drawing shows the various surfaces machined. Total f.t.f. time, just 4.6 minutes—including only .8 minute to load, operate and unload.

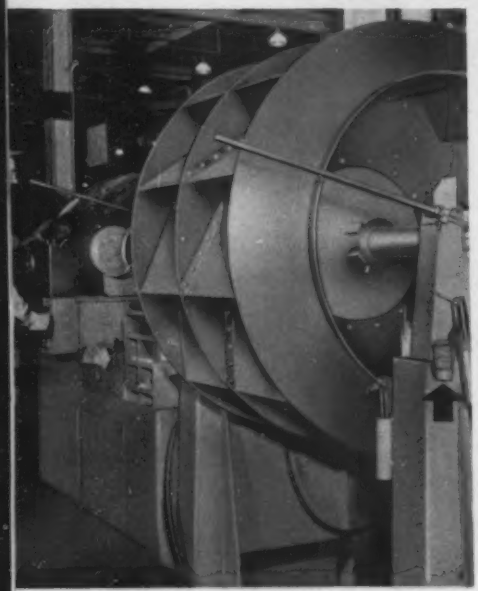
**Loader cuts work-handling time .8 minute per piece. Back-boring attachment permits use of fast, rugged No. 24; cuts machining time 30%; provides greater accuracy, longer tool life, finer finish.**

**For complete facts on No. 24 Auto Chucking Lathe write in No. 2749 on inquiry card.**



# HOW TRANE CO. SAVES ON LARGE-PART JOB-LOT BALANCING

## Balancing machine flexibility and fast setup trim costs



Operator, completing setup, prepares to start balancer. Arrow indicates convenient welding equipment.

**Do you think of balancing in terms of long production runs? Do you consider job-lot balancing too costly to handle in your own shop? This setup shows that even single units can be balanced with greater accuracy for less than it costs to transport the work to and from a balancing subcontractor.**

Accurate balancing is highly important in the operation of centrifugal fan wheels used in air-conditioning, ventilating and industrial process systems. Operating noise must be kept to a minimum and vibration must be eliminated.

The Trane Company, La Crosse, Wisconsin, not only meets those requirements but trims costs on job lots by using a Gisholt Type 6UH Balancer. Machine versatility permits handling wheels from 24″ to 89″ in diameter, 9 15/16″ to 97 13/16″ in width, 80 to 4500 pounds. Lots range from one to 75 units.

Here are the steps for balancing a single part (the 54″ double-width, double-inlet fan wheel shown above):

Workpiece—insert supporting arbor. Machine—insert half bearings and adjust to work width. Load work; attach drive coupling; position angle indicating rods; rotate; note angle and amount of unbalance in each plane; stop work; index and weld correction weights at indicated angles; rotate for inspection reading; make any final correction required; remove. F.t.f. time, just one hour and 45 minutes.

Balancing identical parts is still faster. The machine is set up on the first piece and calibrated to indicate the exact amount of material to be added or removed, in terms of the correction method used. The remaining parts can then be handled in one quick reading.

**Flexible Gisholt Balancer handles wide work range at lowest unit cost. Fast setup saves time—even on 1-piece jobs.**

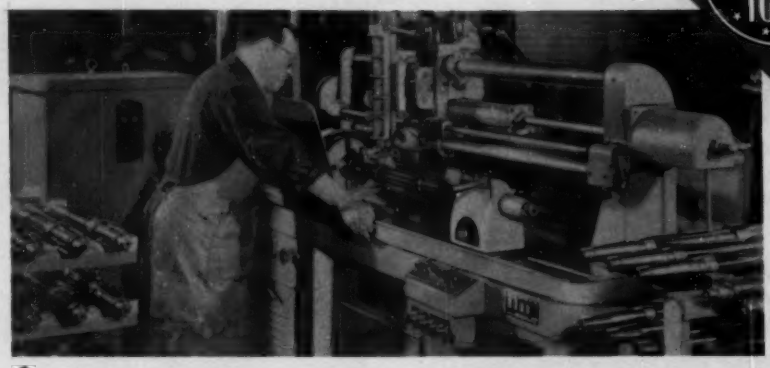
**For complete facts on "U" Balancers write in No. 3749 on inquiry card.**

**ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT**

# LEYLAND MOTORS LTD. SAYS, "SUPERFINISHED PARTS LAST LONGER"

MASTERLINE GISHOLT SINCE 1887

## Superfinishing improves quality, extends service life of heavy-duty transmission parts



Gisholt Model 51-A General-Purpose Superfinisher at Leyland Motors Limited, used to improve quality and lengthen service life on a wide variety of heavy-duty transmission parts. Note how parts are "banked" on racks behind and at right of operator to speed work flow.

Superfinish can cut your costs many ways—it eliminates or reduces grinding time and provides a finer finish for longer service life. It is flexible—can be used on cylindrical, flat, tapered, spherical or eccentric surfaces. Setup is fast and does not require highly trained personnel. Except for loading and unloading, the operator is free for other work.

The setup used by Leyland Motors Limited, Lancashire, England, may give you some ideas on how Superfinish can be used in your own operations. The machine, a Gisholt Model 51-A General-Purpose Superfinisher, handles a wide variety of transmission parts used in cars and trucks.

On the main-shaft setup (shown), 60 pieces are produced per lot. Superfinishing of a single 1½"-long bearing diameter removes .0002" stock. It reduces the previously ground surface to a "controlled" 3 micro-inch RMS finish. F.t.f. time, only 2.4 minutes. Stone life on the 60 Rockwell C material is about 700 pieces.

Superfinishing costs are less, compared to the time and grinding wheel expense that would be required to finish-grind to 3 micro-inches RMS.

**Wide adaptability makes the Model 51-A ideal for job lots or production runs. Savings in cost, plus increased customer satisfaction due to increased service life, justify a thorough investigation of Superfinish on all your parts.**

**For complete facts on 51-A Superfinisher write in No. 4749 on inquiry card.**

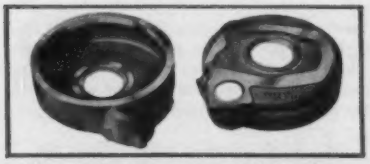
# HERCULES MOTORS SAVES 43% WITH AUTOMATICS ON JOB LOTS

## Fast chucking on versatile Simplimatic is key time-saver

If you produce a variety of parts in small lots, similar in design but varying in dimension, automatics will cut your costs.

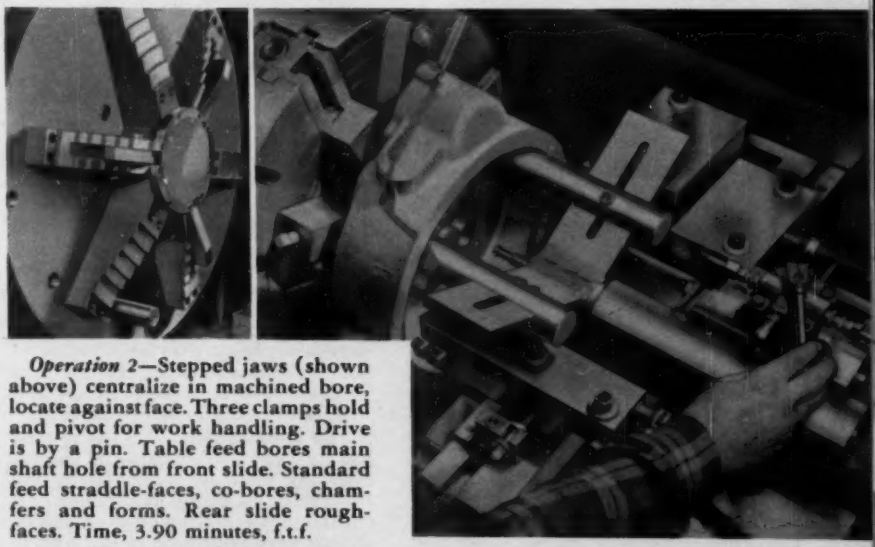
For example, check this setup at Hercules Motors, Canton, Ohio. The first three operations on 11 different sizes of cast iron industrial engine gear housings were being handled on 6 hand-operated lathes. Lots were small, 5 to 200 pieces. Bores ranged from 10" to 20". Annual production was sufficient to justify use of three automatics—if each could be equipped with a single fixture and a set of tooling developed to handle the entire work range.

These requirements were met by three gapped-bed Gisholt MASTERLINE Simplimatics, cutting machining time 43% on these parts.



Here's the sequence on the medium-sized, 14$^{13}/_{64}$"-bore housing shown.

*Operation 1* (setup shown at right)—Three-point loader centralizes work on spring-loaded, tapered chuck jaws, against jacks. A drawbar clamps in small bore. Drive is by a pin in starter gear hole. Open end is faced, bored and chamfered. Time, 3.80 minutes, f.t.f.



*Operation 2*—Stepped jaws (shown above) centralize in machined bore, locate against face. Three clamps hold and pivot for work handling. Drive is by a pin. Table feed bores main shaft hole from front slide. Standard feed straddle-faces, co-bores, chamfers and forms. Rear slide rough-faces. Time, 3.90 minutes, f.t.f.

*Operation 3* (same fixture as operation 2)—Front slide tools rough-turn small hub. Rear slide tools finish 8½" interrupted face. Center slide tools finish-turn and chamfer small hub, finish-bore and chamfer main shaft hole. Time, 7.70 minutes, f.t.f.

**Fixture and tooling, adjustable for wide work range, permit mass-production efficiency on job lots. Three automatics replace 6 hand-operated lathes, cutting time 43%.**

**For complete facts on Simplimatic write in No. 5749 on inquiry card.**



GISHOLT

**MACHINES WITH NEW MACHINE GUARANTEE**

MASTERLINE GISHOLT SINCE 1887

# HOW CANADIAN INGERSOLL-RAND CO., LTD., SAVES ON FIXTURING

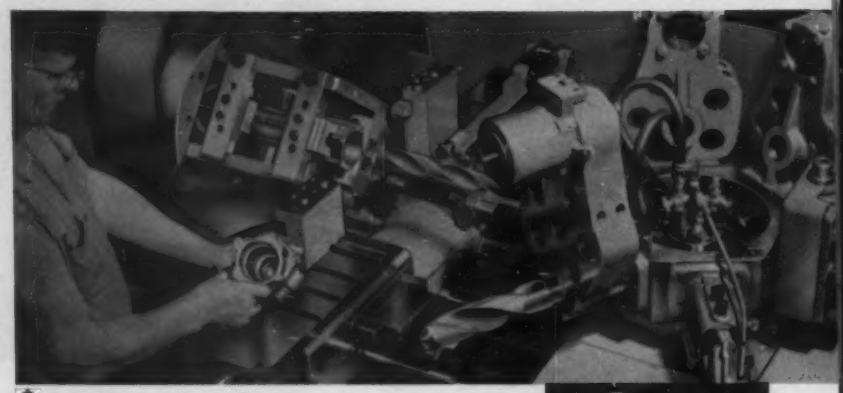
## Fastermatic handles job lots automatically, cuts machining time 50%, change-over time 19%

With the right machine—the right fixturing and tooling—your short-run fixture jobs can be handled automatically at considerable savings.

That's the story at Canadian Ingersoll-Rand Co., Ltd., Sherbrooke, Quebec, Canada. Here over 40 different parts—in lots of 40 to 110—have gone automatic on two Gisholt MASTERLINE 2F Fastermatic Automatic Chucking Turret Lathes (replacing four old automatics). Average machining time has been cut 50%. Setup is 19% faster. Workpieces include long and unwieldy drifter, paving breaker and jackhamer cylinders, washers, handles, cylinder heads and gear blanks for rock drilling equipment.

Shown above is a typical setup for the Universal jackdrill cylinder, held by the operator. The fixture used here provides a 12% saving in chucking alone. Replaceable V-blocks and an adjustable base allow cross, length and height adjustment to accommodate three different cylinders.

Interrupted facing is handled by cross-slide tools. Two drills and three multiple-diameter cutters on the hex turret drill, face and chamfer the 3-diameter bore, completing the part.



Operator holds Universal jackdrill cylinder 12¾" long, 4" maximum face diameter. Note internal machining and interrupted cut on face. Hex-turret-mounted, multi-diameter cutters simplify machining...assure maximum accuracy.



Two additional cylinders handled with same chucking fixture. Note interrupted cuts and deep hole drilling performed by Fastermatic, 50% faster than by former methods.

**Versatile fixturing simplifies chucking of odd-size parts...allows automatic small-lot production. Smooth hydraulic feeds, and machine rigidity permit maximum metal removal. Automatic cycle permits operator to handle two machines.**

**For complete facts on 2F Fastermatic write in No. 6749 on inquiry card.**



# HOW FISHER GOVERNOR CO. BOOSTS PROFITS ON ODD JOBS

## Turret lathes provide faster setup, more parts per shift

Held in face-plate clamping fixture, steel cooling fin head casting is drilled, bored, reamed and chamfered from the hex turret. Square turret tools face, turn and groove. This setup was made to machine four parts.



Any producer has a number of odd machining jobs that must be worked into the daily production schedule. Setups may be required for even a single rush-order piece. Floor-to-floor time on these small lots is important—but not so important as machine flexibility and fast change-over. This is where Gisholt MASTERLINE Turret Lathes pay big dividends.

Fisher Governor Company, Marshalltown, Iowa, uses a battery of 36 Gisholt Ram and Saddle Type Turret Lathes to handle standard production items and odd jobs at lowest cost.

The setup shown, on a Gisholt 2L Saddle Type Turret Lathe, is specifically for small-lot work. Using the same basic clamping fixture, hex and square turret tooling, the 12 pieces shown were machined in just one 8-hour day. Eight different setups were required: one each for a 2-piece and a 4-piece lot; and one each for six pieces. F.t.f. times ranged from 8.2 to 18.8 minutes, depending on size and type of part.

Your costs can be cut, too, with the same turret lathe features that meet Fisher Governor Company's requirements for accuracy and production. Gisholt Turret Lathes are heavier... offer more horsepower...are built to remove more metal to closer tolerances in a given amount of time. Quick setup, ample capacity, low tooling costs and a wide range of easily selected speeds and feeds, plus production-proved accessories, will make light work of your toughest jobs.

Eleven other parts—requiring eight different setups, completed in one 8-hour shift on the versatile Gisholt 2L Saddle Type Turret Lathe.

**For complete facts on 2L Saddle Type Turret Lathe write in No. 7749 on inquiry card.**

**Twelve parts requiring eight different setups completed in one 8-hour shift. Gisholt Turret Lathes assure flexibility, fast change-over and ease of operation for more profits on short runs.**





No. 9-1059
749

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

# GISHOLT MACHINE COMPANY

Printed in U.S.A.

Madison 10, Wisconsin

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes • Packaging Machines • Masterglas Molded Plastic Products

# New Malleable Irons Meet Gruelling Service Tests

Toughness is a vital requirement in stressed parts. Each application, however, requires a particular combination of physical characteristics to be sufficiently "tough."

Whatever the specific requirements, one of the finest groups of materials available is the Malleable irons, as illustrated in the tables below.

**Tensile Properties—A.S.T.M. Minimum Specifications**
**Standard and Pearlitic Malleable Irons**

| Designation | Tensile Strength p.s.i. | Yield Strength p.s.i. | Elongation % in 2 in. | Designation | Tensile Strength p.s.i. | Yield Strength p.s.i. | Elongation % in 2 in. |
|---|---|---|---|---|---|---|---|
| *Standard* | | | | 53004 | 80,000 | 53,000 | 4 |
| 35018 | 53,000 | 35,000 | 18 | 60003 | 80,000 | 60,000 | 3 |
| 32510 | 50,000 | 32,500 | 10 | 80002 | 100,000 | 80,000 | 2 |
| *Pearlitic* | | | | | | | |
| 45010 | 65,000 | 45,000 | 10 | | | | |
| 45007 | 68,000 | 45,000 | 7 | | | | |
| 48004 | 70,000 | 48,000 | 4 | | | | |
| 50007 | 75,000 | 50,000 | 7 | | | | |

Strengths up to 135,000 p.s.i. tensile and 110,000 p.s.i. yield are produced commercially under individual producers' specifications.

**Other Mechanical Properties**
**Standard and Pearlitic Malleable Irons**

| | *Standard* | *Pearlitic* |
|---|---|---|
| Modulus of Elasticity in Tension, p.s.i. | 25,000,000 | 26,000,000—28,000,000 |
| Ration of Fatigue Strength to Tensile Strength | 0.54 | 0.40—0.50 |
| Shear Strength—% of Tensile Strength | 80—90% | 70—85% |
| Torsional Strength | Approximately equal to Tensile Strength | |
| Compressive Strength, p.s.i. | 200,000 | 250,000 |



Malleable's toughness is illustrated in a severe test conducted by a manufacturer of cab-over-engine trucks. To be absolutely sure of the strength and toughness of a variety of components in the cab, including the critical Malleable iron cab support hinges, a truck was crashed at high speed into a barricade of ice. Result—no hinge damage, even though the truck was seriously battered.

## Service-Demonstrated Toughness

Highway railing posts demonstrate Malleable castings' use where impact resistance is critical. As an example, thousands of Malleable railing posts line the Connecticut State Thruway. The State Highway Department reports that there have been no failures of the Malleable iron posts although other materials have failed in several cases.

It is also because of Malleable's toughness that so many of the highest quality hand tools are made of Malleable iron. One leading tool manufacturer tests the quality of its pipe wrenches by using a trick well known as the best way to break a wrench. The wrench jaws are put on a rigid bar, a long pipe is slipped on the handle, and the tester heaves his weight downward on the pipe. Because of their confidence in Malleable's toughness, this company unconditionally guarantees every Malleable wrench housing against distortion and breakage. Another hardware manufacturer makes a similar guarantee against breakage on its line of Malleable vises.

But Malleable iron's proven performance in field service is only one reason for its wide use. To this, you must add Malleable's low first cost, design flexibility, and excellent machinability. This combination offers unique advantages over other metals.

## Design and Production Assistance Available

To assist in the use of Malleable castings, a special bulletin on toughness—Data Unit No. 105—is available from the Malleable Castings Council, Union Commerce Building, Cleveland 14, O. These bulletins and engineering and planning assistance are also readily available to you from any member of the Malleable Castings Council.

**These companies are members of the**

MALLEABLE CASTINGS COUNCIL

**CONNECTICUT**
Connecticut Mall. Castings Co., New Haven 6
Eastern Malleable Iron Co., Naugatuck
New Haven Malleable Iron Co., New Haven 4

**DELAWARE**
Eastern Malleable Iron Co., Wilmington 99

**ILLINOIS**
Central Fdry. Div., Gen. Motors, Danville
Chicago Malleable Castings Co., Chicago 43
Moline Malleable Iron Co., St. Charles
National Mall. and Steel Castings Co., Cicero 50
Peoria Malleable Castings Co., Peoria 1
Wagner Castings Company, Decatur

**INDIANA**
Link-Belt Company, Indianapolis 6
Muncie Malleable Foundry Co., Muncie
Terre Haute Mall. & Mfg. Corp., Terre Haute

**MASSACHUSETTS**
Belcher Malleable Iron Co., Easton

**MICHIGAN**
Albion Malleable Iron Co., Albion
Auto Specialties Mfg. Co., Saint Joseph
Cadillac Malleable Iron Co., Cadillac
Central Fdry. Div., Gen. Motors, Saginaw

**MINNESOTA**
Northern Malleable Iron Co., St. Paul 6

**NEW HAMPSHIRE**
Laconia Malleable Iron Co., Laconia

**NEW JERSEY**
Meeker Foundry Company, Newark 4

**NEW YORK**
Acme Steel & Mall. Iron Works, Buffalo 7
Frazer & Jones Company Division Eastern Malleable Iron Co., Solvay
Oriskany Malleable Iron Co., Inc., Oriskany
Westmoreland Mall. Iron Co., Westmoreland

**OHIO**
American Malleable Castings Co., Marion
Canton Malleable Iron Co., Canton 5
Central Fdry. Div., Gen. Motors, Defiance
Dayton Mall. Iron Co., Ironton Div., Ironton
Dayton Mall. Iron Co., Ohio Mall. Div., Columbus 16
Maumee Malleable Castings Co., Toledo 5
National Mall. and Steel Castings Co., Cleveland 6

**PENNSYLVANIA**
Buck Iron Company, Inc., Philadelphia 22
Erie Malleable Iron Co., Erie
Lancaster Malleable Castings Co., Lancaster
Lehigh Foundries Company, Easton
Meadville Malleable Iron Co., Meadville
Pennsylvania Malleable Iron Corp., Lancaster

**TEXAS**
Texas Foundries, Inc., Lufkin

**WEST VIRGINIA**
West Virginia Mall. Iron Co., Point Pleasant

**WISCONSIN**
Belle City Malleable Iron Co., Racine
Chain Belt Company, Milwaukee 1
Federal Malleable Company, West Allis 14
Kirsh Foundry Inc., Beaver Dam
Lakeside Malleable Castings Co., Racine
Milwaukee Malleable & Grey Iron Works, Milwaukee 46



For more data, circle this page number on inquiry card



# "Been workin' her hard for 14 years ...she's as fast and accurate as the day she arrived"




# NIAGARA SHEARS

Precision made Niagara Shears are built to cut with micrometer accuracy . . . *and to keep cutting that way.*

Thousands are in use, but comments are nearly identical. Makes no difference how hard they're worked. Three shifts a day, month after month, year after year . . . a Niagara Shear *continues* to be accurate.

## "Don't have to change knife clearance"

No adjustments needed for cutting different thicknesses of stock . . . even at the same time . . . with consistently accurate, burr-free results. *And much longer knife life!* The secret is in the rigidity of Niagara's exclusive box section design. "Upped production 25%," says one user, "because we have fewer adjustments to make."

## "Costs less to operate"

There's less to do, less to learn and less to go wrong. Never even have to worry about damaging the machine by forgetting to change the knife clearance. Once set, Niagara Shears need no further adjustment. "Been using Niagara's for 10 years . . . never had downtime for repairs or maintenance," says another user. Even after long, hard use when it becomes necessary to turn the blades or change knives, it's a very easy matter. Nothing like Niagara Shears for simplicity.

### FACT BOOK FOR YOU

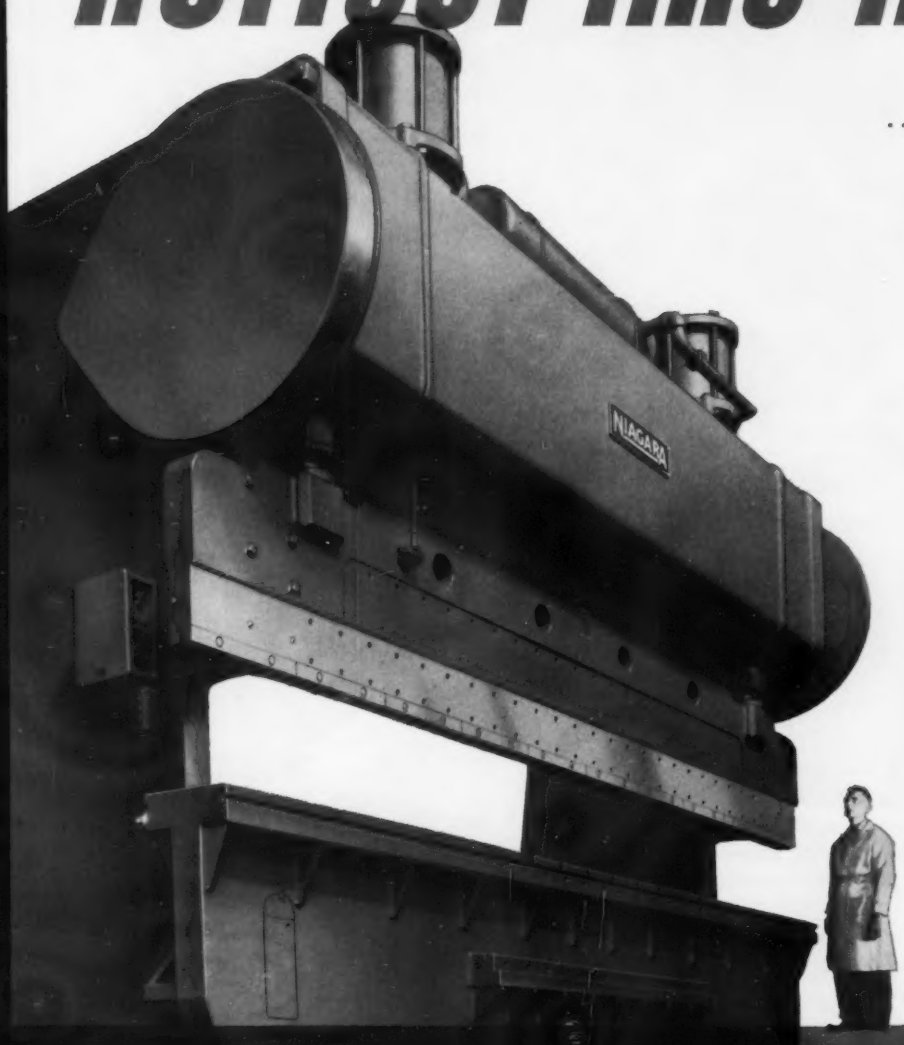
Bulletin 69 is filled with customer reports on Niagara Shear performance. You'll value it. Write today.



**NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.** *District Offices and Distributors in Principal Cities*

# NIAGARA PRESS BRAKES

# hottest line in '59




**...way out front in production-boosting, cost-cutting features... highest dollar value of all**

Hottest line in the industry, more Niagara Press Brakes are being bought today than ever before.

What's behind it? **Performance!** Downright, measurable, press brake performance! High hourly output with minimum operator effort is setting new work standards in plant after plant.

How about you? Want to sail through your schedules at record-breaking speed... cut your operating and maintenance costs to the bone... hold your capital investment to a **practical minimum... then Niagara is the press brake for you.**

Talk it over with a Niagara sales engineer. He has the facts to give you a fair comparison **...on every point.**

*77 sizes to choose from*

- 15-1500 tons
- Power or Manual Clutch
- Smooth, micro-inching ram
- Wear resistant non-metallic ways
- Gearing enclosed in sealed oil bath



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*completed parts...*

# COLD HEADED

*from wire!*



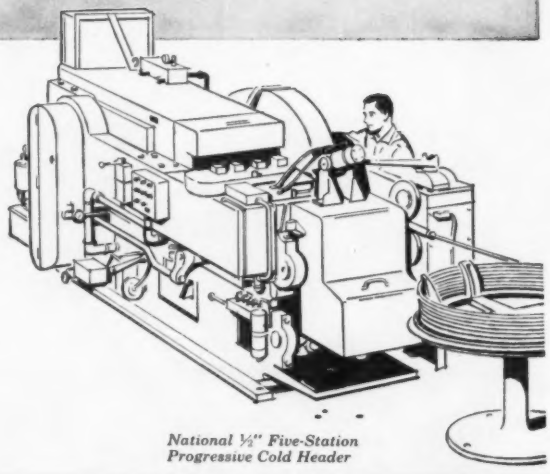
Top row, left to right: pipe plug, ball seat for push-rod end, splined square-head shaft. Middle row: commutator bar, solenoid contact, wire clamp. Bottom row: distributor cap insert, transistor case, spacer, link, distributor cap center wire insert.

All of the odd-shaped metal parts above were developed for fast, accurate production on National Cold Headers.

Complete and ready to use, these parts are made from wire, start-to-finish in one compact machine, at unbelievably high speeds with excellent die life, in most cases with no loss of material!

Production ranges from 40 parts per minute with stock of 1½" diameter up to 450 per minute in the ⅛" size. The jobs illustrated average 161 per minute.

Have you investigated Cold Heading? If you now have headers, have you considered widening your range and type of work to meet the growing requirements of metalworking?



*National ½" Five-Station Progressive Cold Header*

*Founded 1874—DESIGNERS and BUILDERS of MODERN FORGING MACHINES • MAXIPRESSES • REDUCEROLLS • COLD HEADERS BOLTMAKERS • NUT FORMERS • TAPPERS • NAILMAKERS CO-PIONEERS WITH INDUSTRY OF ADVANCED METALWORKING PRODUCTION METHODS*

**NATIONAL MACHINERY CO.**

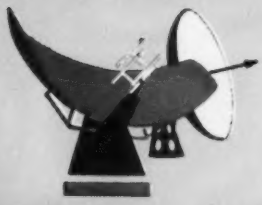
*TIFFIN, OHIO, U. S. A.*

**HARTFORD DETROIT CHICAGO**



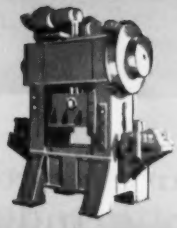
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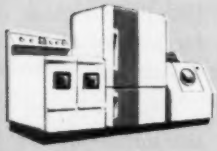


make more





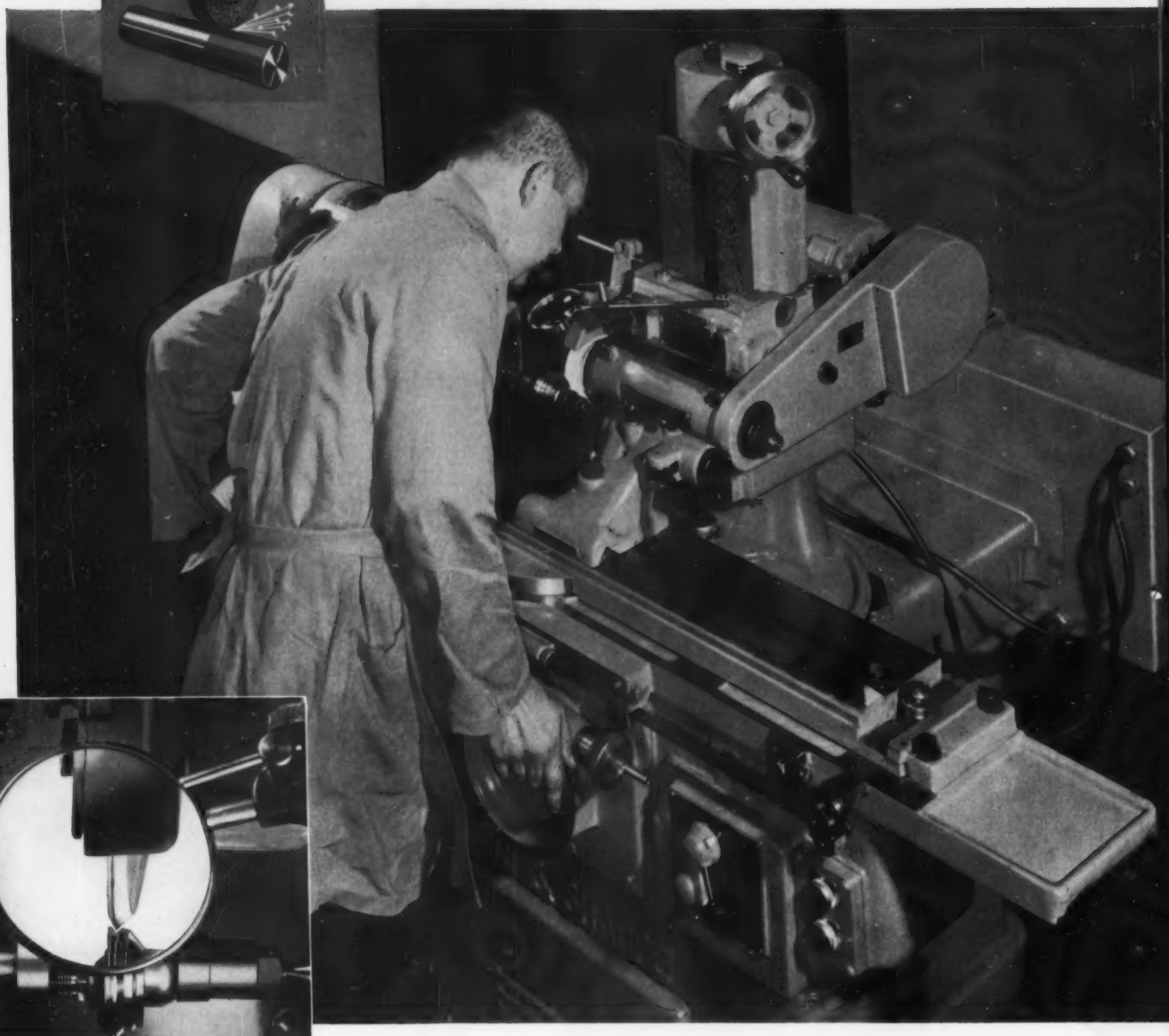
for less . . .



Brown & Sharpe PRECISION CENTER

TO HELP YOU GRIND MORE FOR LESS







## Two-machine output from single-machine investment—No. 13 tool grinder doubles for production

The Brown & Sharpe No. 13 Universal and Tool Grinding Machine is the leading choice in its class for all-around utility. Watch it turn out the work anywhere it's installed, and you'll see why.

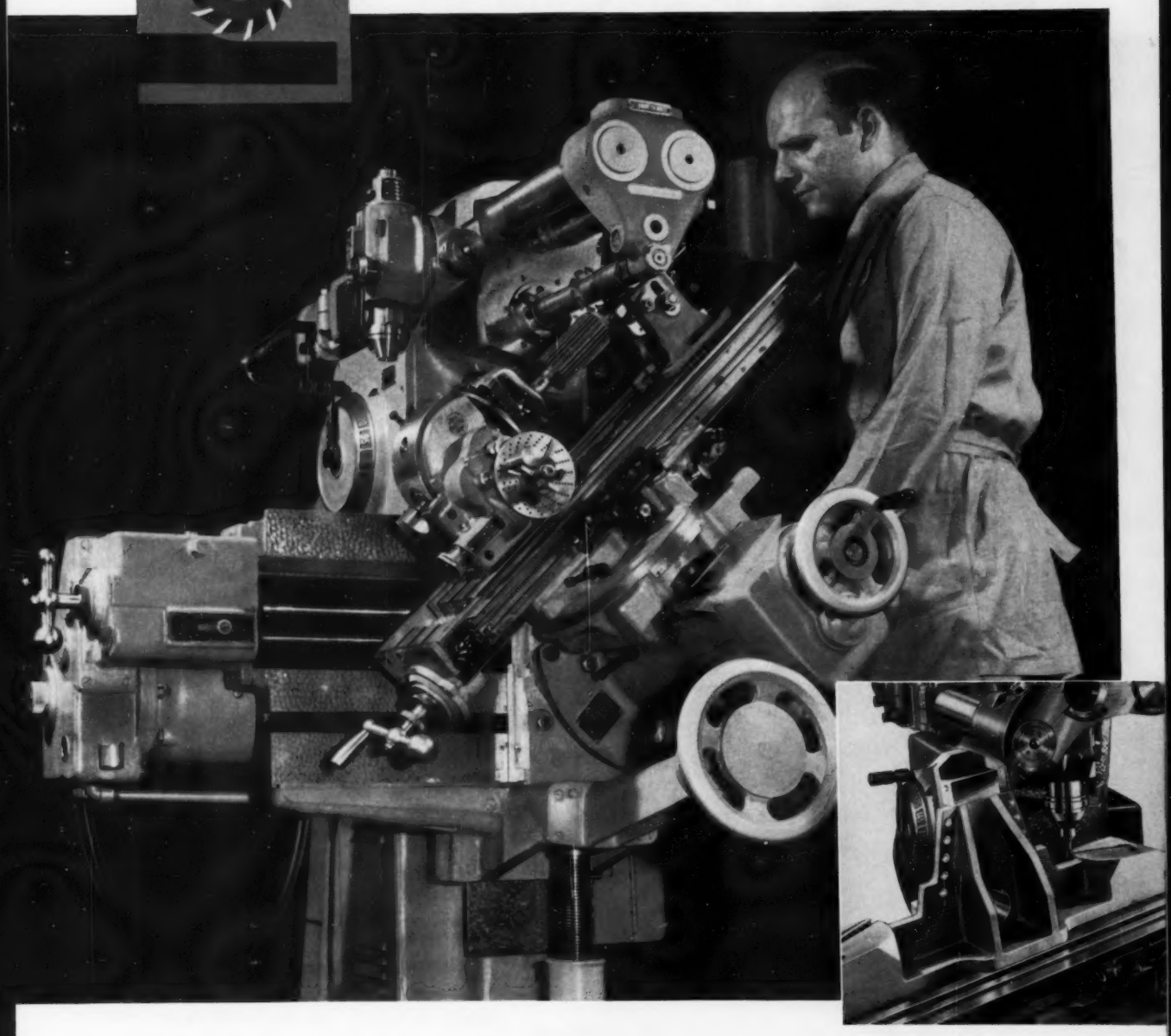
It grinds helical and formed cutters, end mills and side mills—meets every need for tool sharpening. It is industry's favorite for circular form tool grinding. It offers unlimited adaptability for tool and die making, and for grinding parts needed in experimental, prototype, and repair work. In addition, it has ample capacity for a wide variety of light production grinding.

Now, new improvements in drive design further increase its proved efficiency. Find out how the No. 13 can start saving for you.

For details, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

**Brown & Sharpe** PRECISION CENTER

TO HELP YOU MILL MORE FOR LESS



## The Omniversal makes the cuts that "can't be done" - meets today's demands for toolroom milling

The Brown & Sharpe Omniversal Milling Machine is a standard machine "made-to-order" for the complex milling increasingly required in toolroom, experimental, and prototype work. Nothing else can match its combination of work-range, versatility, and dependable accuracy.

It simplifies the multi-operation jobs—permits milling at various angles without relocating work—saves set-up time. It handles spiral taper and other complex cuts that are impossible on other machines. Plenty of capacity, too —with a total horizontal feed of 34″, and a 15″ vertical adjustment.

When you invest in toolroom milling equipment, get the machine that will do *all* the work, and pay top returns in dollars saved . . . get the Omniversal.

For details, write: Machine Tool Division. Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

**Brown & Sharpe** PRECISION CENTER

TO HELP YOU DRILL MORE FOR LESS



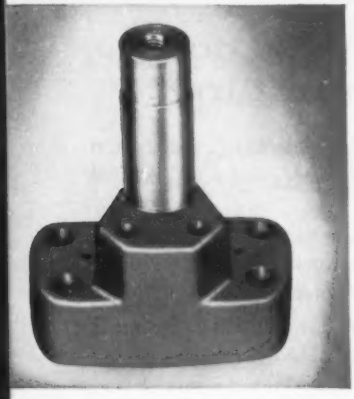
Two sizes: Model A (shown) 6 spindles • ½" drilling and tapping capacity in steel • table work surface 22" x 24". Model B 6 spindles • 1" capacity in steel • table work surface 28" x 32" • may be equipped with any standard numerical (tape) control system for fully integrated automatic work positioning and machining.

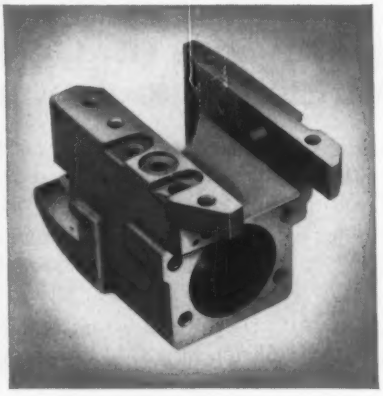
## Drill • tap • bore • ream... 2 to 5 times faster

Turret drilling, developed by Brown & Sharpe's newest division, is the revolutionary system for production drilling operations that can save up to 80% of your costs for conventional gang-drill box-jig methods.

Multiple drilling operations are performed at a single station, with one set-up. Brown & Sharpe Work-positioning Tables permit accurate duplication of any hole pattern, eliminate need for expensive box jigs. You save work transfer and set-up time. You save on tool wear and maintenance. You save floor space, and reduce your capital investment. In many installations, Brown & Sharpe Turret Drilling equipment has paid for itself in a year or less.

Write for complete information, and ask for estimate of savings you can make by tooling up for B&S Turret Drilling. Brown & Sharpe Turret Drilling Division, Inc., 20 Fitch St., East Norwalk, Connecticut.



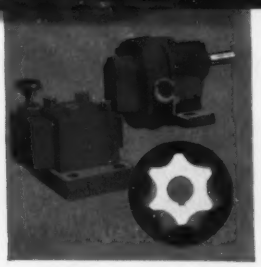


## The Stanley Works speeds drilling production with Brown & Sharpe Turret Drilling Machines

At The Stanley Works, New Britain, Conn., B&S Model A Turret Drilling Machines are used to lower costs of drilling component parts for the pneumatic operating units of the famous Stanley MAGIC-DOOR Controls. In the spindle (left), an SAE 1035 steel forging, four .432" holes are drilled and reamed, two .307" holes drilled and reamed, and two .149" holes drilled — 14 operations in 4 minutes. The B&S Work-positioning Table and the simple holding fixture assures accurate hole location.

In the cylinder block (right), 11 holes are drilled and tapped, 1 hole drilled and counterbored, and 5 holes drilled. All 17 holes — 29 operations in four planes — are completed in 7 minutes.

**Brown & Sharpe** PRECISION CENTER



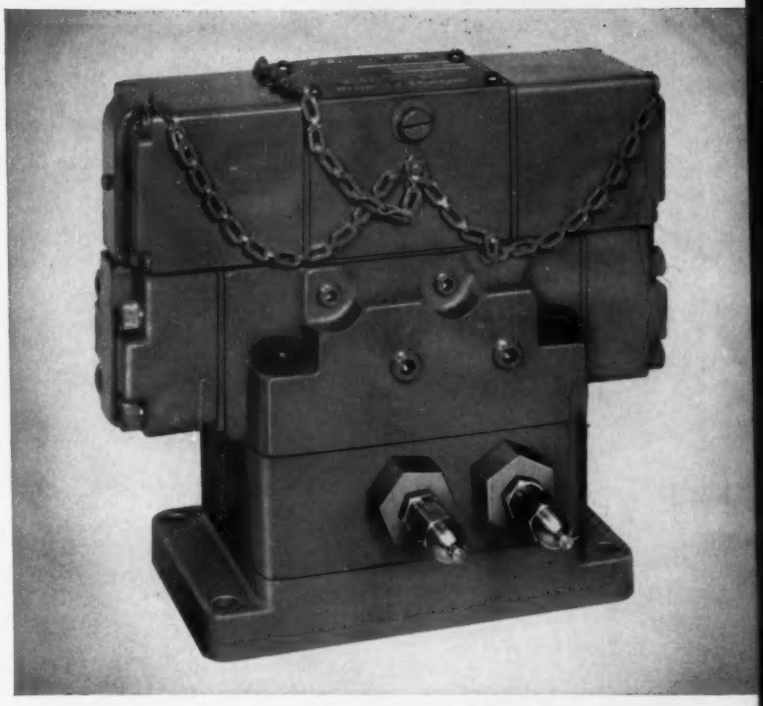
TO HELP YOU HANDLE FLUIDS
MORE EFFICIENTLY... AND FOR LESS

## New Double A "Circuit-Stak" Valves save up to 75% of installation costs

Circuit-Stak valves are a new Brown & Sharpe concept: a "sandwich" of several valves required for a hydraulic circuit, assembled in one compact unit on a single sub plate.

You save up to 75% of the usual installation cost for separate valves, because Circuit-Stak installs as easily as a single valve — eliminates separate mountings and piping runs. Valves in the sandwich can be easily removed or replaced.

For literature on Double A hydraulic control valves, power units, Gerotor pumps, write Double A Products Co., a subsidiary of Brown & Sharpe Mfg. Co., Manchester Michigan.



**Above:** Simple Circuit-Stak combining double flow control valve, "sandwiched" under 4-way valve, costs about $36 less to install than if valves were separately mounted.

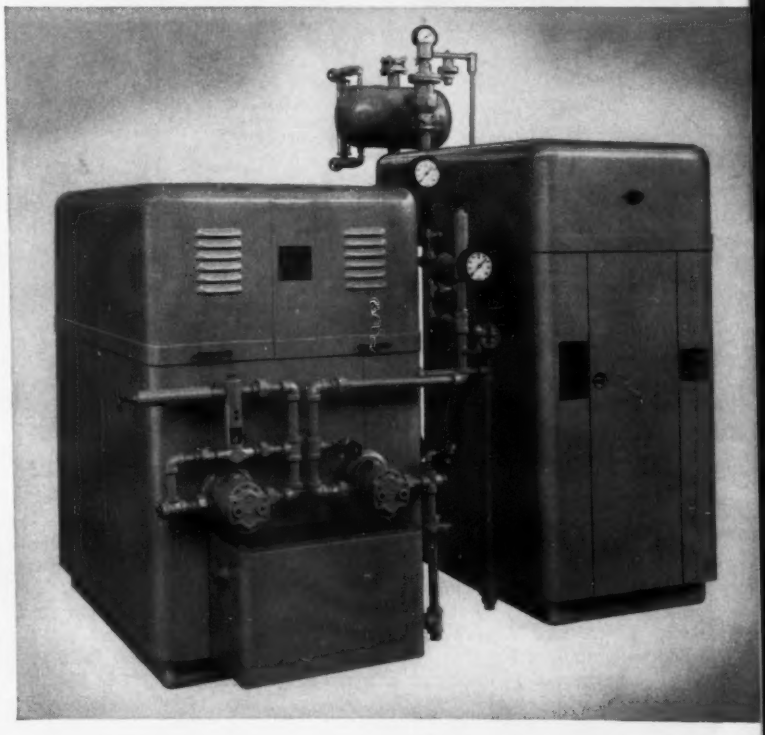
**Below:** Famous Votator chilling and plasticizing units for shortening and lard are manufactured by Girdler Process Equipment Division, Chemetron Corporation, Louisville, Ky.

## B&S "stock" pumps meet tough requirements in "Votator" units

The reasons why Brown & Sharpe rotary geared pumps have been built into "Votator" vegetable-shortening and lard processing units for over 15 years, are important to any pump user . .

First, B&S tolerances between moving parts are so close that they reduce slippage of hot oils to an absolute minimum — at 250-300 psi. Second, B&S fine internal finishes assure extra-long service life. Equally important, the B&S pumps that meet Votator requirements so well are *inexpensive* — available right from stock.

Send for your copy of the new Catalog No. 36P, which describes the complete line of B&S gear, vane and centrifugal pumps. Brown & Sharpe Mfg. Co., Providence 1, R. I.



**Brown & Sharpe** PRECISION CENTER

TO HELP YOU MAKE PRECISION MEASUREMENTS EASIER AND FASTER...



New Brown & Sharpe Convertible Thimble Micrometer

# Precision Tool News

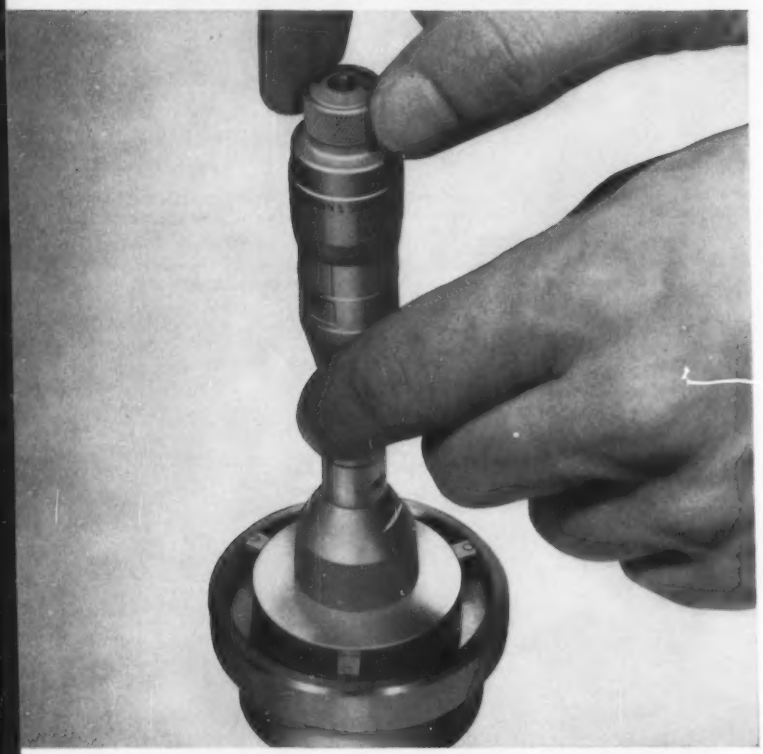
## 3 new B&S features make this the world's most advanced micrometer

Only in Brown & Sharpe's new Convertible Thimble Micrometer do you get these 3 important features for convenience and accuracy . . .

First, you can use either of two measuring "feels" in the same micrometer. By just turning a friction control, you convert in seconds to "friction" feel or . . . direct feel (knurled sleeve locked to thimble.)

Second, you use this mike, easily, in one hand. The friction sleeve is placed where you can reach it without stretching, and the new lever-type lock works with your thumb.

Most important, for accuracy, are the new oblique (slanting) barrel graduations. By showing "where you're going and where you've been", they prevent the .025″, one-revolution errors that often occur when older style, straight graduations are hidden. Range is 0-1″, in .0001″.



**New Intrimik measures diameters in .0002″ to bottom of blind bores.** This Style B Intrimik is an advanced version of the famous internal tri-point micrometer that Brown & Sharpe introduced 5 years ago. It is very versatile because it measures diameters, directly, right to the bottom of holes — extra long-lasting because measuring points and all wearing parts are carbide; wear adjustments are provided. Self-centering, self-aligning points are protected from damage by not protruding beyond end of head. Available in six sizes, with setting rings and extensions — individually or in sets — for measuring diameters from .600″ to 2.400″ in .0002″, to depths of 14″. Accurate over full range to .00015″.



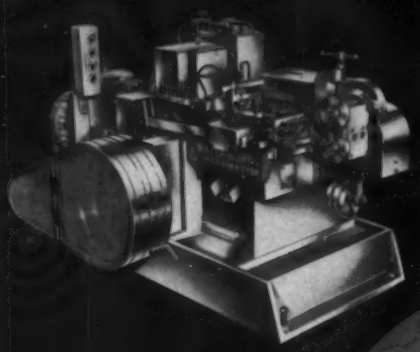

## New Brown & Sharpe pre-colored flat stock saves time

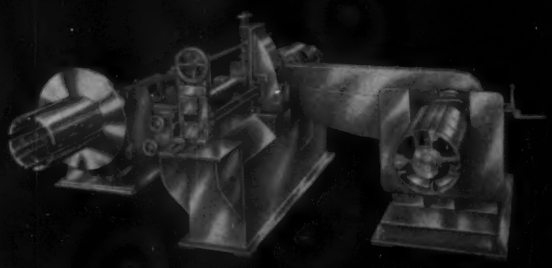
Brown & Sharpe's new Ready Mark precision ground flat stock comes with a smooth, rust-resistant colored finish — ready for scribing. You save degreasing, coloring, drying time. Coating instantly identifies stock; it's blue for oil-hardening, maroon for air-hardening stock.

Ask your local Brown & Sharpe distributor to show you these products, available quickly from his stock. Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

**Brown & Sharpe** PRECISION CENTER

COLD HEADING
MACHINERY

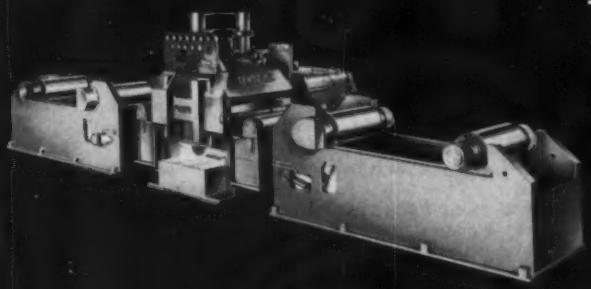


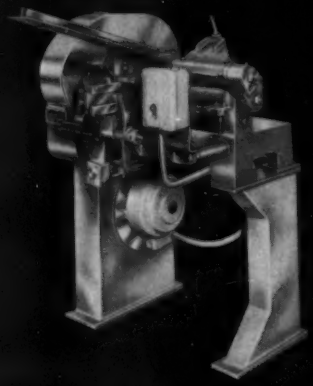


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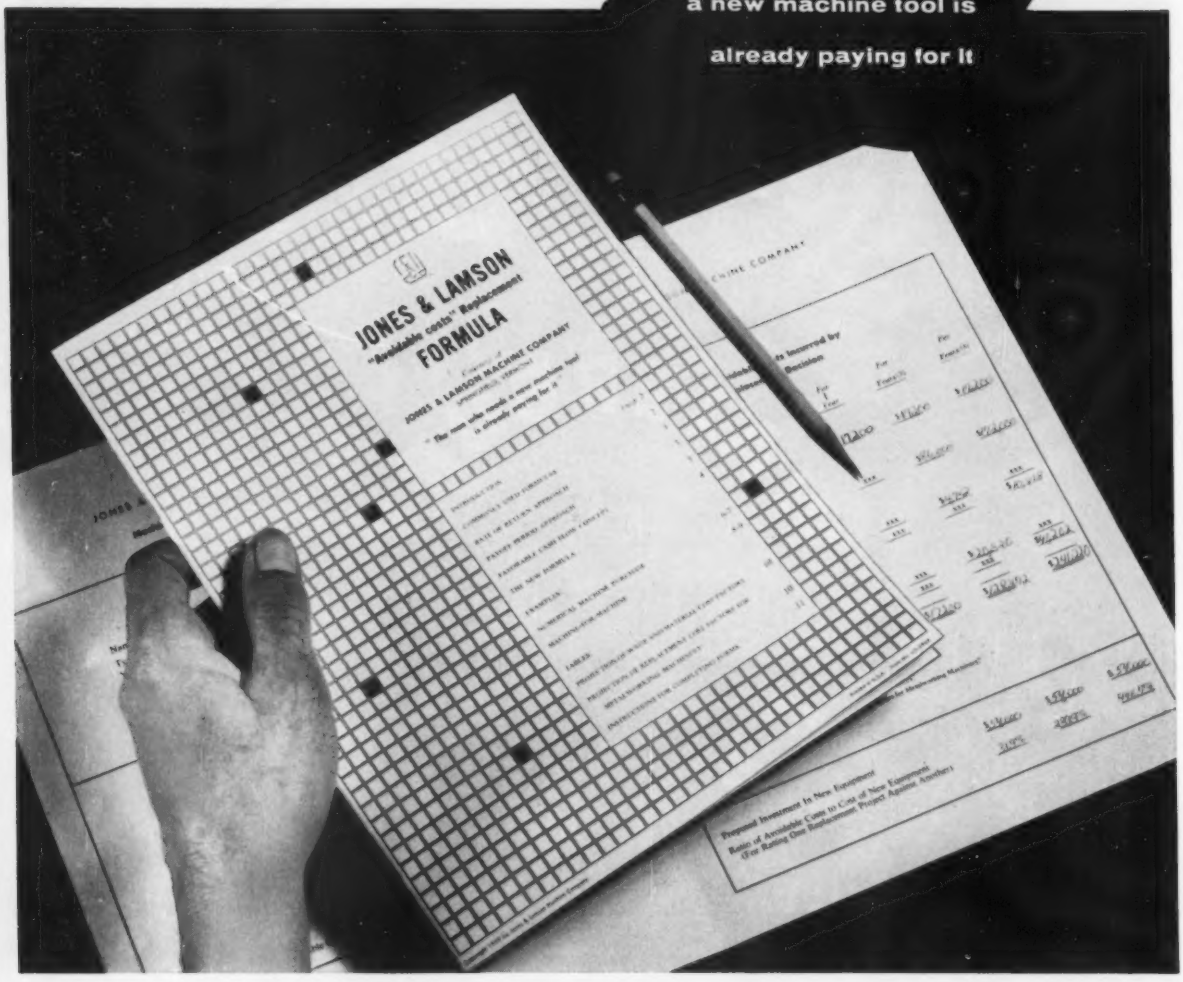


POWER
PRESSES

THE WATERBURY FARREL FOUNDRY & MACHINE CO.
DIVISION OF TEXTRON INC.
Waterbury, Connecticut, U.S.A.
Sales Offices: Chicago • Cleveland • Los Angeles • Millburn, N. J.

# JONES & LAMSON MACHINE COMPANY

the man who needs a new machine tool is already paying for it




## How to get Equipment Dollars from Management

To management men, nothing speaks so eloquently as facts. Take the men in *your* front office, for instance. When told that a new machine tool (or several new ones) is a "must", they may very well be inclined to agree. But they have to be *shown*.

In order to sell management, you must present an accurate, factual statement, comparing current productivity of existing equipment, with the productivity attainable with new, advanced equipment.

And this is where you must exercise extreme caution.

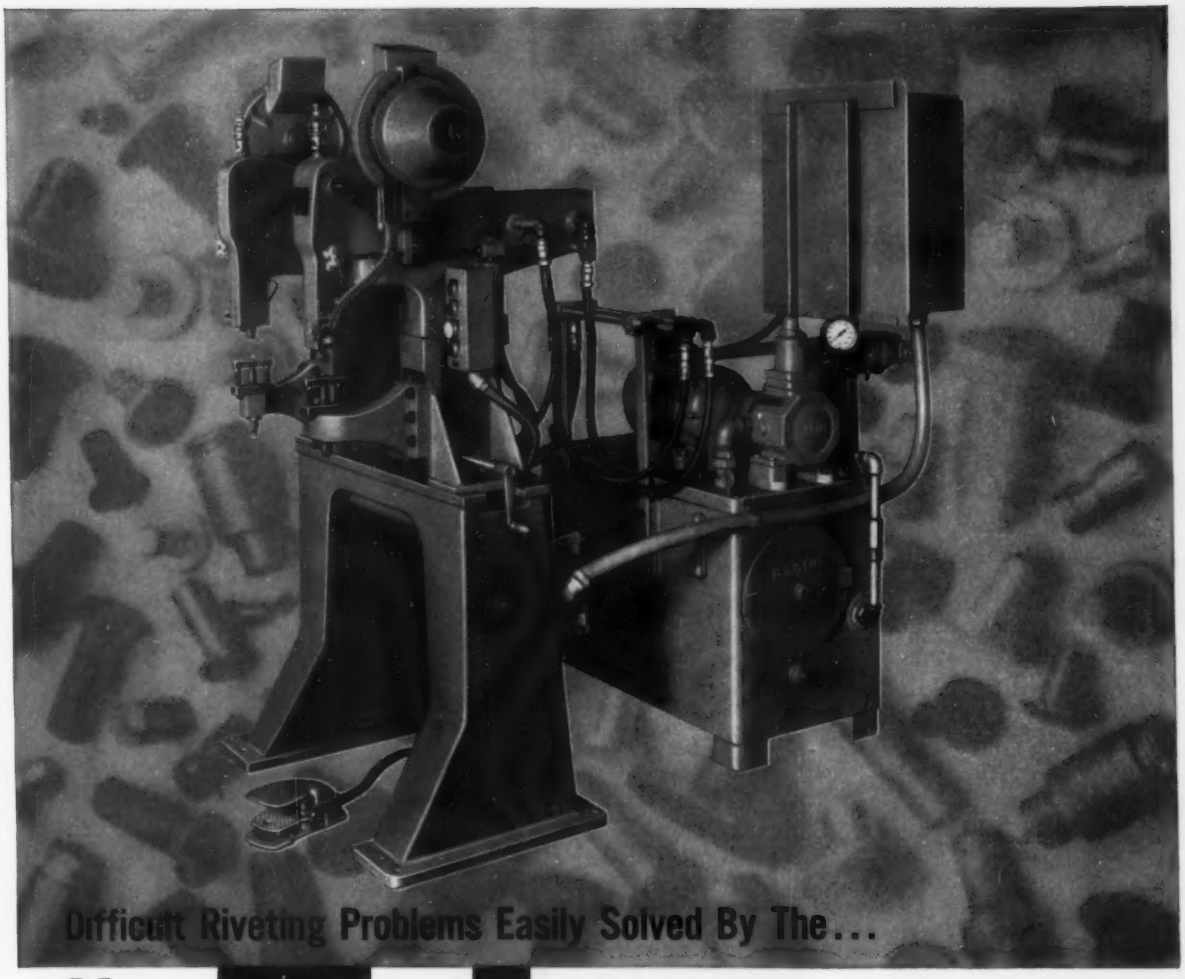
Why?

Because, practically without exception, the formulas commonly used for evaluating machine tool performance contain flaws, fallacies and limitations which are seriously misleading. They give an erroneous picture because they distort the facts.

Happily, J & L has the answer to this problem. It's the new J & L "Avoidable Costs" Replacement Formula, which gives you an easy, step-by-step method of productivity evaluation which is logical, accurate and reliable. This formula is tried and true. It gives you a clear, true picture and supplies you with the facts you need in order to get that new machine you're looking for.

For your copy of J & L's "Avoidable Costs" Replacement Formula, together with easy-to-use work sheets, write Jones & Lamson Machine Company, 512 Clinton Street, Springfield, Vermont.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools




# New T-J HYDRAULIC DUAL RIVITOR

## With Increased Riveting Production • Quality • Versatility

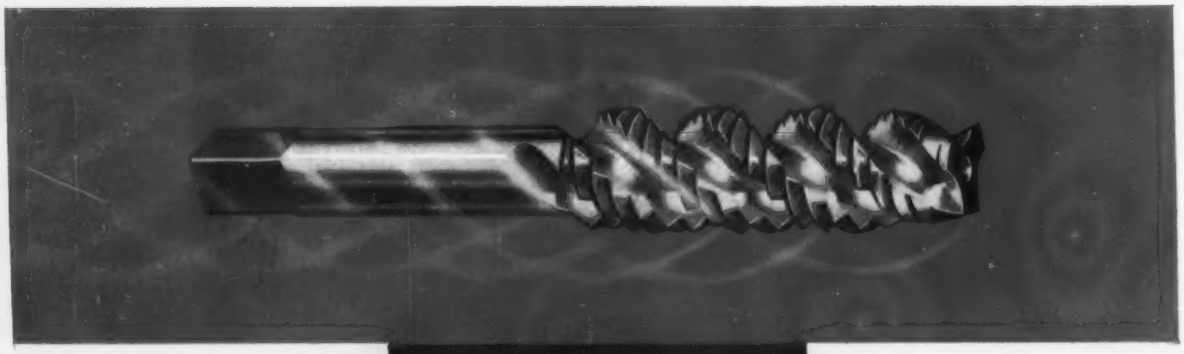
Added recently to the versatile T-J line of unit and production line riveting and clinching machines is the new Hydraulic Dual Rivitor. The Model HDR will set two ¼″ solid steel rivets at once with adjustable spacing from 1-½″ to 18″ maximum, center to center, being fed from 10″ hoppers. Operating cycle is approximately .8 second, at 420 P.S.I. oil pressure furnished from a hydraulic power unit with maximum of 1000 P.S.I. output. For complete specifications write to The Tomkins-Johnson Co., 2425 W. Michigan Ave., Jackson, Michigan for Bulletin HDR-4-59.

For information on other T-J Rivitors and Clinchors write for Bulletin No. 555.

T-J TOMKINS-JOHNSON
RIVITORS . . . AIR AND HYDRAULIC CYLINDERS . . . CUTTERS . . . CLINCHORS



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# TURBO-CUT

**the tap that's changing the meaning of "high production"**

The reports we're getting from our field men on Turbo-Cut Tap performance are self-explanatory.

Here's a sample from one day's mail:

"This tap was run on an aluminum carburetor part and started to run undersize after 32,160 holes."

"We currently have a 5/16-24 Turbo-Cut that is still going after 18 shifts and over 43,000 holes."

"A #10-24 Turbo-Cut plug tap ran 18,200 holes on a zinc die cast job."

Threadwell's Turbo-Cut is piling up records like these daily. Every plant interested in increased production should take a look at the tap that really means "high production". See your threadwell Distributor now for details.

Only Threadwell makes the genuine Turbo-Cut.

Threadwell
MAKES THE BEST PRODUCT BETTER

INDUSTRIAL DISTRIBUTORS
SERVING INDUSTRY ECONOMICALLY
THE RIGHT HAND OF PRODUCTION

THREADWELL TAP & DIE CO.
GREENFIELD, MASSACHUSETTS

Stocking Warehouses: New York — Cleveland
Detroit — Los Angeles — Greenfield, Mass.

# Machine Complex Parts Without Secondary Operations

on

## BECHLER SWISS AUTOMATICS



Actual Size – Material: 416 Stainless Steel

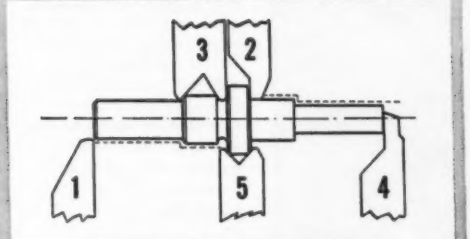
This highly finished piece is one of a mass-produced lot machined in one set-up from type 416 stainless steel. Eleven separate operations were performed without loss in the traditional precision performance of swiss automatics. Conventional methods would have necessitated costly secondary machining —incurring a loss of concentricity and a high reject rate, especially on such tough materials.

The Bechler model BR-20, with 11 tool stations, its famous single point turning, long-life carbide tools, machined this part in one operation. Rejects and costs were held to an absolute minimum through the unusual versatility and precision of the Bechler machine.

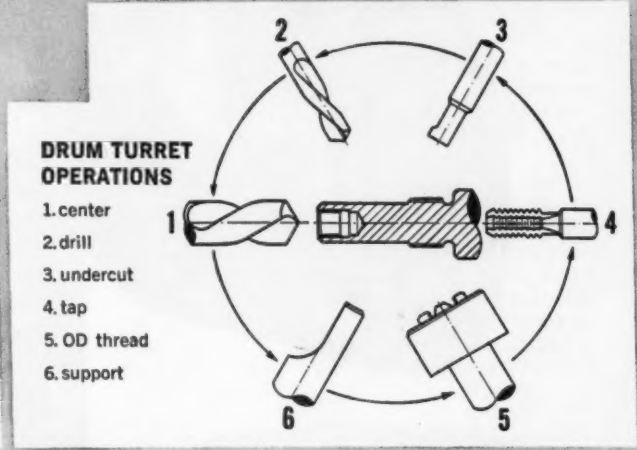
with 6 Spindle Drum Turret



**BECHLER Model BR-20**
¾" Dia. Capacity—up to 8" turning capacity
5 micrometer controlled cross tools—
6 station drum turret with hydraulic indexing.




**CROSS TOOL OPERATIONS**
1. front turn – 2. back turn – 3. thread chamfer
4. cut off – 5. fork chamfer




**DRUM TURRET OPERATIONS**
1. center
2. drill
3. undercut
4. tap
5. OD thread
6. support

Schematic drawings showing the eleven (11) operations accomplished in one set-up on the Bechler Model BR-20.

**Write Today For Further Information**

**COSA** — *nationwide sales and service of precision machine tools —from bench lathes to boring mills.*

**COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.**

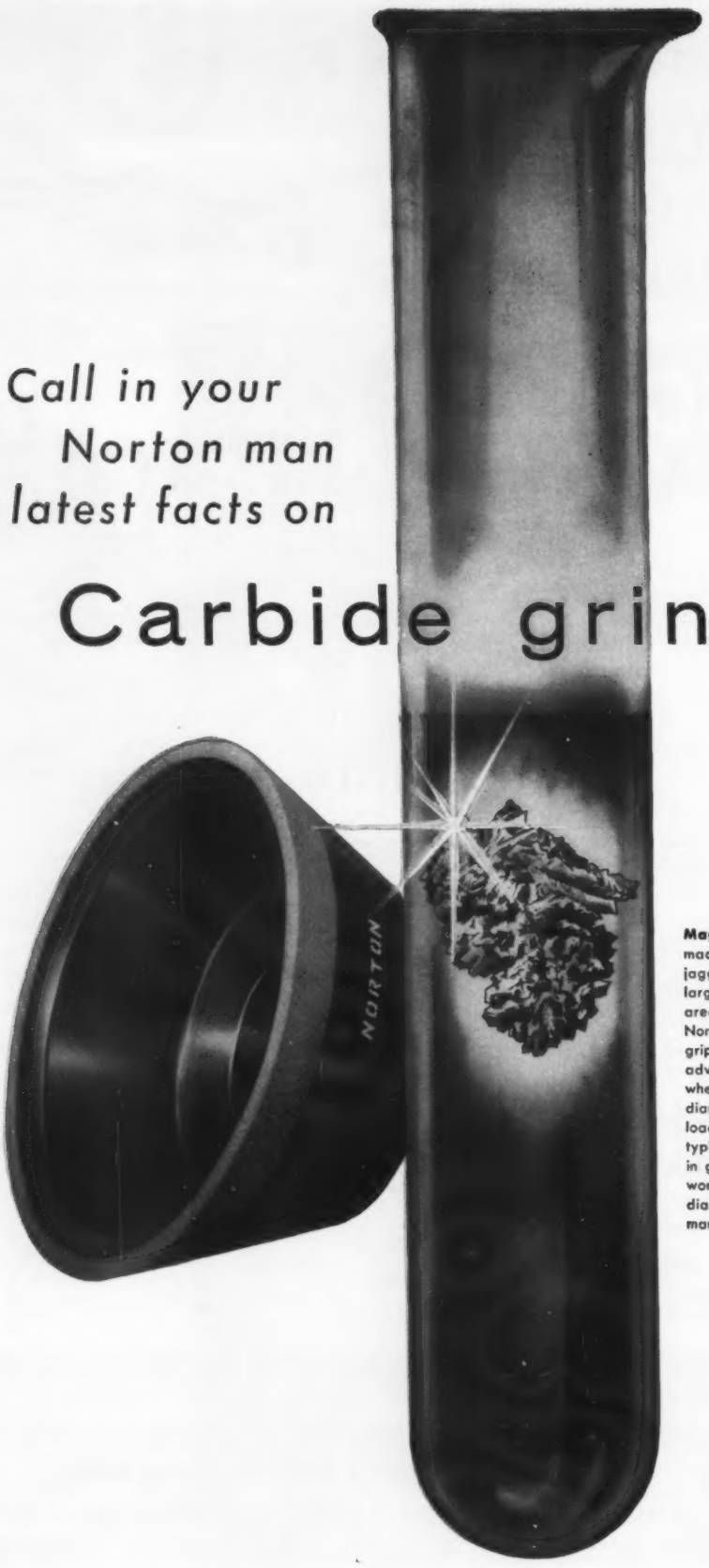
Service:—Bechler Service Corporation—28 Harbor Street, Stamford, Connecticut



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*Call in your Norton man for the latest facts on*

# Carbide grinding




**Magnified View** of a man-made diamond. The extremely jagged surface provides a large, tight-holding contact area for bonding. In the new Norton SD wheels this extra gripping power, teamed with advancements in diamond wheel construction, reduces diamond loss and carbide loading to a minimum — typical of Norton leadership in getting the maximum working power out of all diamonds, mined or man-made.

# with Norton wheels

## *using mined or man-made diamonds*

Norton diamond wheels — the most complete line for carbide grinding — are backed by pioneering never equalled, whether the diamonds used are mined or man-made.

Norton began its leadership in diamond wheel development back in 1930 . . . introduced all three bond types (resinoid, metal and vitrified) of diamond wheels . . . does all its own sizing and checking of diamonds . . . duplicates wheel specifications with constant accuracy.

Today Norton leadership continues with the use of man-made diamonds. Among the newest, most efficient materials produced for industry, man-made diamonds last longer in grinding wheels for many carbide grinding operations because they are more firmly anchored in the bond . . . and because their greater friability presents new cutting edges faster, thereby decreasing power requirements and speeding cutting action.

These properties of man-made diamonds are used to their fullest advantages in the new Norton SD resinoid and vitrified wheels. This has been proved in more than a year of nation-wide, comparative testing . . . *In 63% of hundreds of field tests the average service life of Norton SD diamond wheels was at least 25% longer than the life of wheels using natural, mined diamonds, with no loss in cutting action.*

With each Norton diamond wheel, of mined or man-made diamonds, you get a certificate of the accuracy of diamond concentration. You can depend on this certificate to mean exactly what it says and what you're paying for.

You can depend on your Norton Man, too. This expert Abrasive Engineer has kept close contact with the development of man-made diamonds for grinding applications since the start. He can help you take a giant step forward in your carbide grinding — can show you how to get better grinding quality, longer service life and lower cost grinding for every dollar you spend on diamond wheels. NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

NORTON
ABRASIVES

**Making better products . . . to make your products better**

W-1915

**NORTON PRODUCTS:** Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes



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**PORTA-CHECK®**
A transistorized portable comparator for fast accurate measurement in both "tenths" and "thousandths" scales.



**MODEL AG AIR GAUGE**
For checking diameters, dimensions, roundness, etc.

# AMEs

## *Masters of Measurement...*

For more than half a century, Ames measuring instruments have been regarded as the finest made. Today the constantly growing line of Ames indicators, gauges, micrometers and comparators includes such amazingly accurate instruments as the new Ames "PORTA-CHECK", an electronic comparator which gives accurate readings *in millionths of an inch*; and the new Model AG air gauge—also accurate to millionths of an inch. Wherever precision is *really* important . . . you'll find Ames "masters of measurement" on the job.

*Representatives in Principal Cities*

B.C. AMES CO.

*27 Ames Street, Waltham 54, Mass.*

*Canadian Office — B. C. Ames Co., 45 Oriole Parkway, Toronto*

MANUFACTURERS OF MICROMETER DIAL INDICATORS AND GAUGES

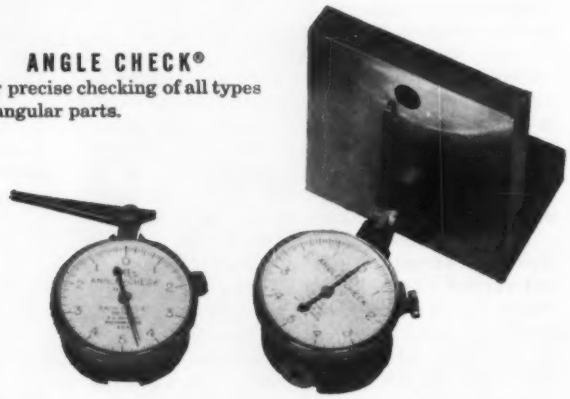
**200 SERIES MICROMETER DIAL INDICATOR**
One of four sizes. Made to AGD specifications.

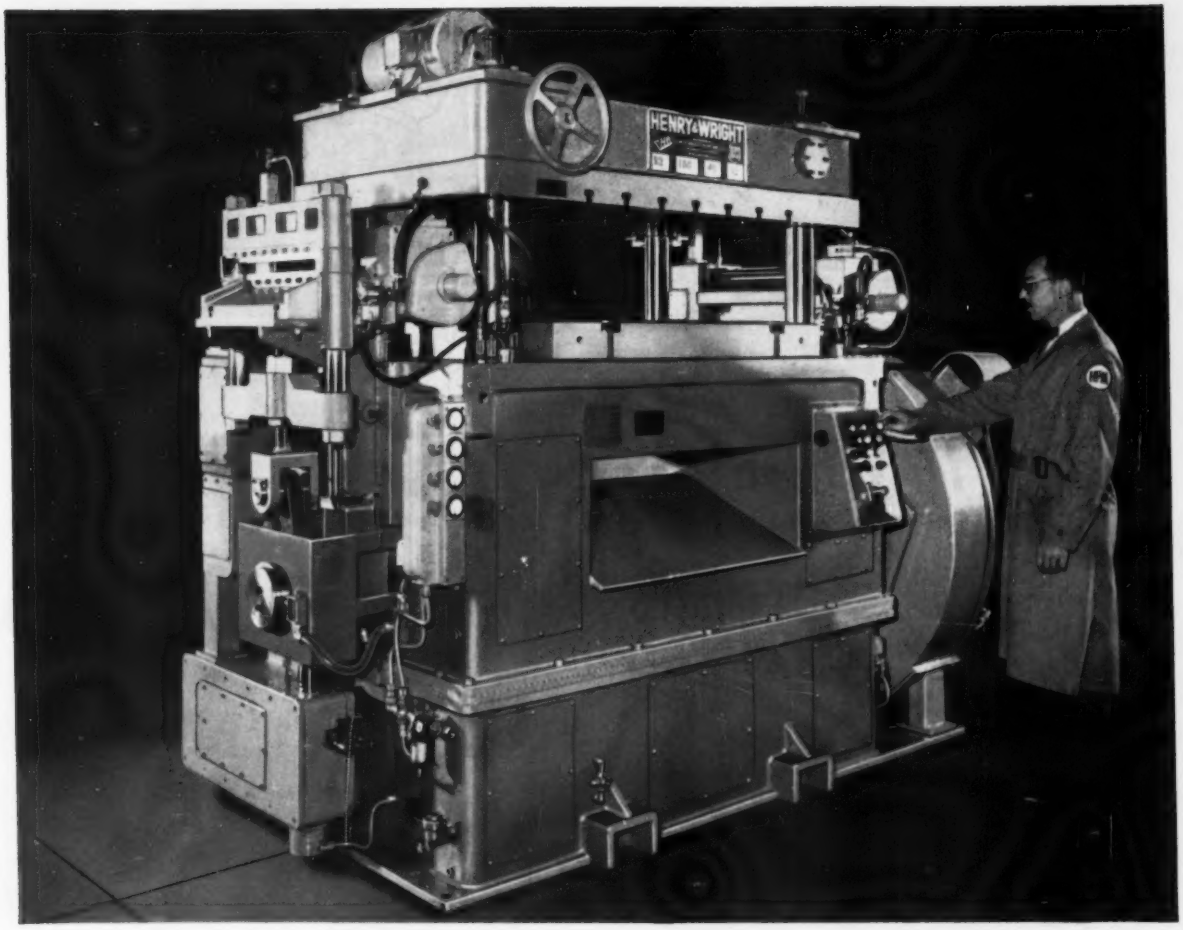





**NO. 2 DIAL COMPARATOR**
For desk, bench or at-the-machine inspection of small parts.

**ANGLE CHECK®**
For precise checking of all types of angular parts.






# DOUBLE DIE-LIFE, DOUBLE PRODUCTION OUTPUT

## *with Henry & Wright Double-Crank Dieing Machines*

The advantages of progressive stamping are adaptable to many everyday stamping jobs through Henry & Wright double-crank dieing machines. Four basic advantages place H & W's in a new competitive position:

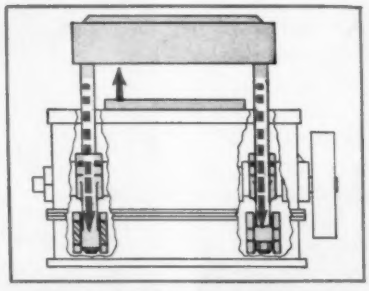
**(1) Form larger parts on lower tonnage machines with double crank design;**

**(2) provides greater precision and longer die life;**

**(3) overall height is reduced to about half that of conventional straight side presses — less head room required;**

**(4) they're more compact; sizes to 150-ton do not require a pit. Operator sees entire die bed while standing at controls.**

Add these major production advantages to a design that reduces maintenance through automatic safety controls and the popularity of the new H & W's is quickly understood. Here's where you benefit:



• All principal bearings are lubricated by a motor-driven recirculating oil system, sealed against contaminants.

• Crankshaft bearings are thermal-switch controlled. Press cannot operate except within safe temperature limits.

• Lower base is insulated against vibration and pounding.

• Discharge chutes are conveniently located for stackers or automatic conveyors.

• Air pressure is used on the feed rolls instead of springs. Easier to adjust, release, last longer. Feed pitch can be changed while machine is in operation.

• Dies may be inserted from front or rear without moving roll feed. Faster die set-ups save valuable time.

The ability to properly handle off-center loading with more uniform distribution of applied force is probably the greatest advantage for large stamping production. Greater accuracy, better quality and longer die life are natural results. Find out about these new, cost-reducing dieing machines. Write for new Catalog.

HPM

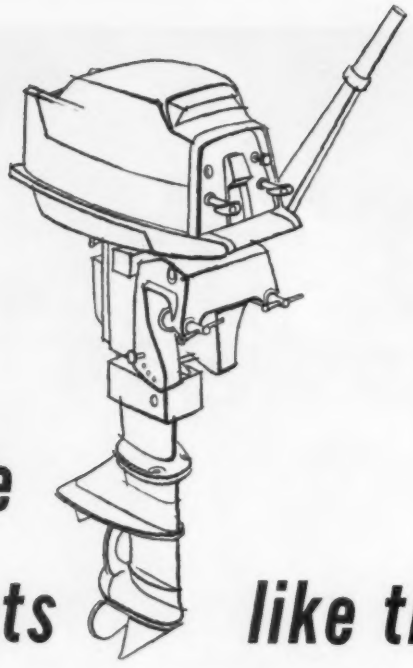
H-93R

**THE HYDRAULIC PRESS MFG. COMPANY**

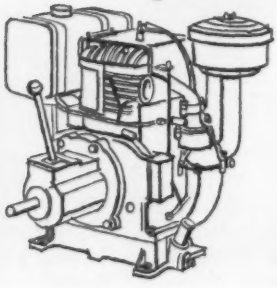
A Division of Koehring Company
Mount Gilead, Ohio, USA

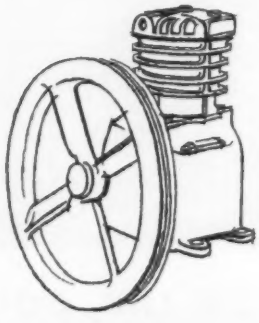


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# If you make products like these.....





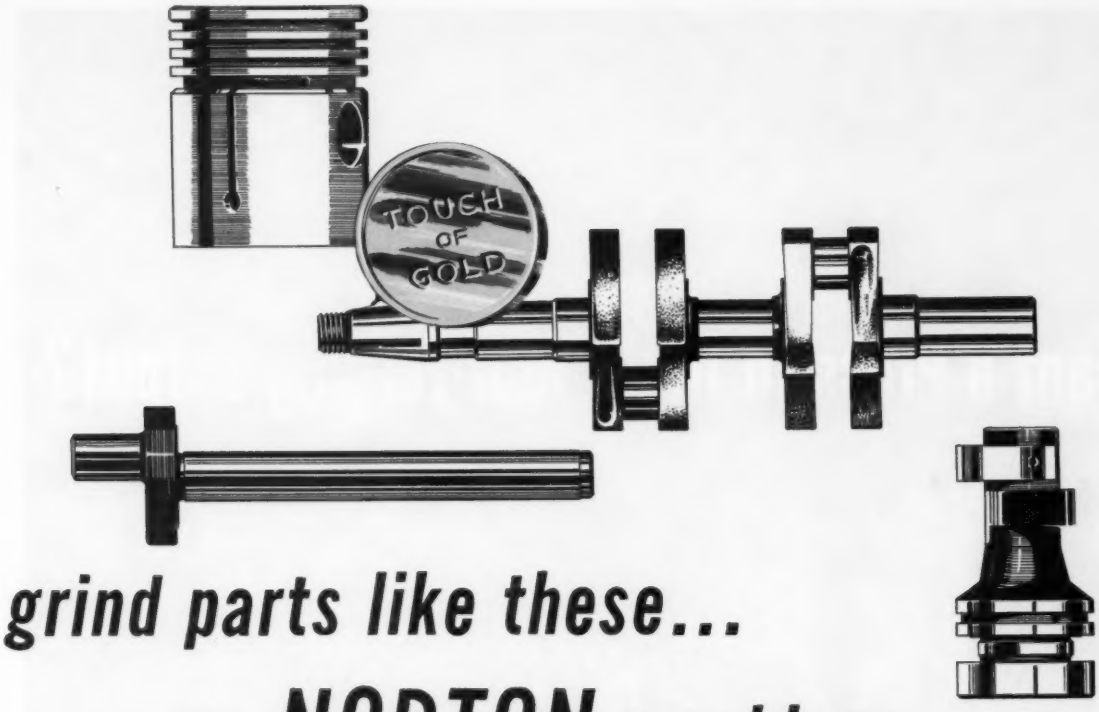



**A Norton Type CV-4 Angular Wheelslide Grinder,** 10″ semiautomatic, grinds the bearing diameters and adjacent shoulders of the outboard engine crankshaft shown above. Two other Norton machines are used in grinding this part: a 10″ Type LCTU for the center main bearing and a 10″ Type CTU CRANK-O-MATIC* crankpin grinder for the throws.




**A Norton CAM-O-UNIT* Mechanism** attached to a Norton Type CTU cylindrical grinder. This smooth-working grinding team broadens the scope of a proved cylindrical grinder, assuring excellent, low-cost grinding of the small piston and the motorcycle camshaft shown, as well as other special shapes.

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries




# grind parts like these...

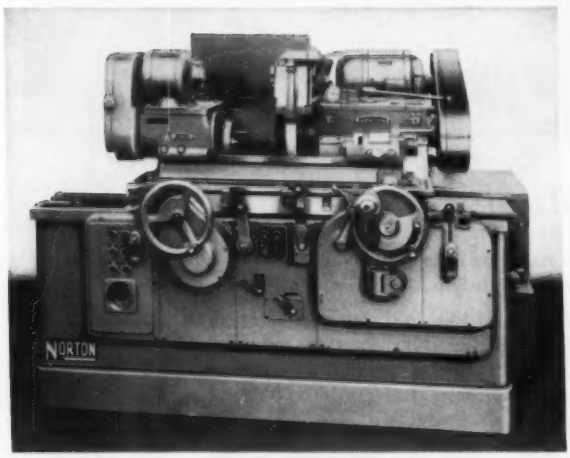
# on NORTON machines

The longer it takes you to grind parts for popular, mass-produced products, the more it costs you. If your grinding machines are below par, so are your profits.

Norton grinders can help you cut production time and costs to the very lowest. You have plenty to choose from — cylindrical, angular, crankpin and other grinder types, together with CAM-O-UNIT mechanisms that enable CTU machines to grind cams and special shapes with precision accuracy.

Norton grinders — all of them — are engineered for fast, accurate, easy operation, simplified maintenance and long, trouble-free service life. By combining several grinds in one job, a single Norton machine for your production can easily replace two or more ordinary grinders.

Your Norton Man, an expert grinding engineer, is always ready to help you select the grinding equipment you need to improve product quality and build your profits. NORTON COMPANY, Machine Division, Worcester 6, Mass. District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.




**A Norton Type CTU Cylindrical Grinder,** 6" x 18" semiautomatic, with live spindle headstock, is used for grinding the household refrigerator compressor shaft, shown above. Areas ground are the short off-set diameter, the shoulder and part of the shaft — typical of the Type CTU's ability to perform several grinding operations at one time.

**NORTON**

**GRINDERS and LAPPERS**

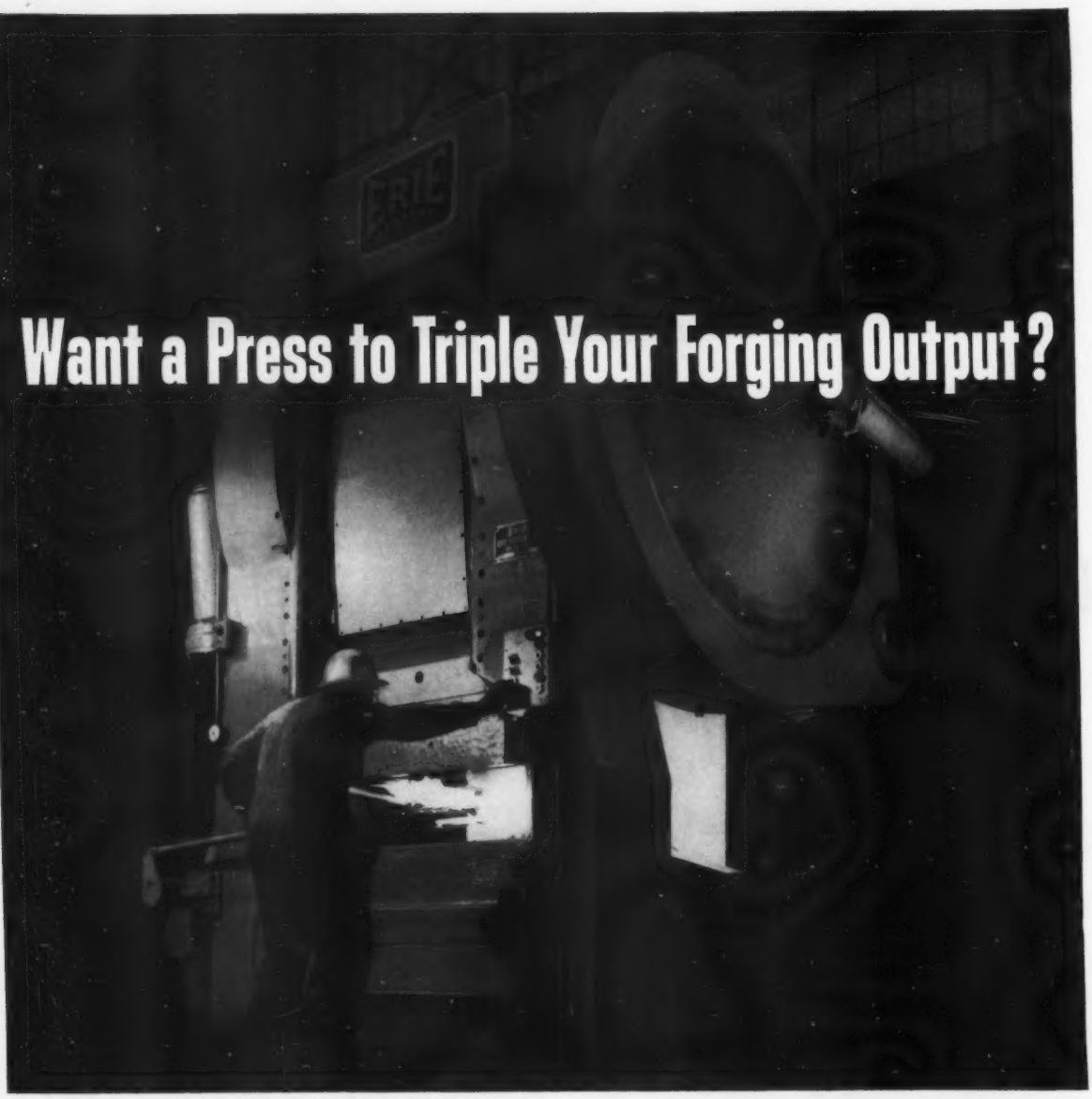
**Making better products . . .**
**to make your products better**

**NORTON PRODUCTS:** Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electro-Chemicals — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes



For more data, circle this page number on inquiry card

# Want a Press to Triple Your Forging Output?



## *We'll build the press for all your forging requirements . . .*

Tell us your forging problems and give us your production specifications—we'll do the rest.

Erie Foundry, one of the first companies to automate forging, can provide specially designed *high volume* presses in capacities of 1000 to 8000 tons. Instead of the three machines and nine men formerly required, now you need only one Erie automated forging press and only one operator observer—to triple your present production rate! Trimming, too, can be accomplished in a single production cycle. With billet supply and finished part removal conveyorized, it is possible to achieve a production volume of, say, 1200 track-link forgings per hour.

Erie Foundry has a complete line of machines designed for high volume production of such parts as connecting rods, gear blanks, automotive and tractor valves, pinions, track links and wheel hubs.

We would like to discuss application of automated presses to your production requirements. For the complete story, phone or write Mr. R. E. Sanford, Erie Foundry Company, Erie 5, Pa.

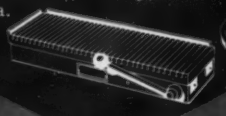
ERIE

**ERIE FOUNDRY CO.**

*The world's great name in forging since 1895* EF-59-01

# World's largest, most complete line of permanent and electro-magnetic and vacuum chucks

Walker permanent magnetic chucks utilize ceramic magnets which have *three times* the coercive force of alloy magnets. Rectangular chucks are available in 6 stock sizes, 6 x 10″ to 12 x 24″; rotary, from 4″ to 60″ dia.

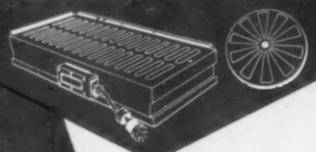


Walker Chucks are designed and engineered to give efficient and completely dependable performance in all applications. The incomparable combination of structural and operating features makes Walker Chucks your best buy in every way.

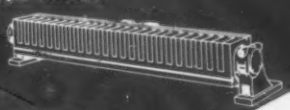
Small, thin work is easily handled with Walker bar pole electro-magnetic chucks. Rectangular in 81 sizes, from 6 x 12″ to 30 x 96″.



Holding jigs and fixtures are eliminated when you use Walker electro-magnetic chucks. Rectangular in 72 stock sizes, from 4 x 8″ to 30 x 96″; rotary, from 6″ to 36″ dia.



In addition to the extensive range of stock sizes of permanent, electro-magnetic, and vacuum chucks and holding fixtures, Walker is your best source for "specials" for specific applications.



Walker has long been the leader in the field of demagnetizers. Stationary, hollow core demagnetizers are made to order in any size and shape of gap from 1″ square up.



For complete information on the entire Walker line, write for Catalog No. 58.

O. S. WALKER COMPANY, INC.
WORCESTER 6, MASSACHUSETTS, U. S. A.

Walker vacuum chucks for holding non-ferrous parts are made to order in any desired size and shape. Favorites in the aircraft industry, they solve the problem of holding non-ferrous sheet stock. From 4″ dia. to 10 ft. x 24 ft.



O.S.Walker

*O. S. Walker—The Original Designers and Builders of Magnetic Chucks!*



For more data, circle this page number on inquiry card

# For The *Best Cut*, The CORRECT KNIFE CLEARANCE Must Be Used

Steelweld Shears are available for all thicknesses of steel to 2 inches and for lengths to 30 feet. Electric foot-switch operation, as illustrated, is furnished as standard equipment.



In 10 seconds the knife clearance on Steelweld Shears can be adjusted to suit the thickness of metal being cut. It's merely a matter of turning a hand crank until the gauge pointer is on the proper figure.

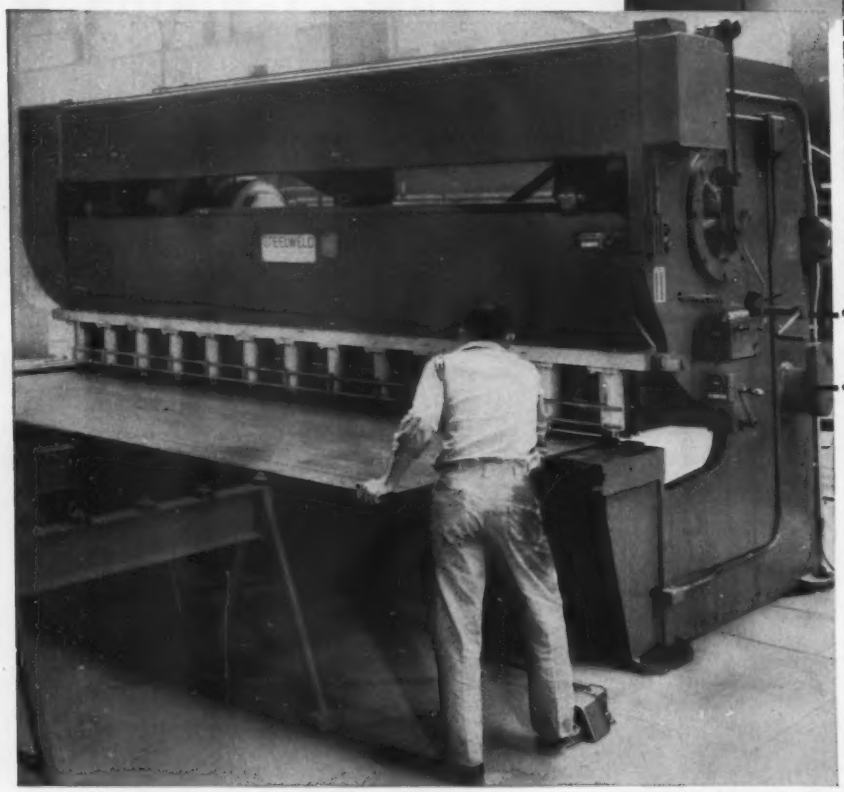


**Table of Recommended Knife Clearances**

| Gauge | Steel | Stainless |
|---|---|---|
| 10 | .012 | .007 |
| 8 | .014 | .009 |
| 3/16 | .016 | .010 |
| 1/4 | .021 | .014 |
| 5/16 | .027 | .018 |
| 3/8 | .032 | .022 |
| 1/2 | .043 | .029 |
| 5/8 | .053 | |
| 3/4 | .064 | |
| 7/8 | .075 | |
| 1 | .086 | |

FOR every plate thickness there is a definite space or clearance between the knives that will produce the best result. When cutting different thicknesses of metal, it is necessary to vary the knife clearance accordingly.

One of the important differences between Steelweld Pivoted-Blade Shears and all others is the ease with which the knife clearance can be adjusted on Steelwelds. With most shears this is a major operation involving the use of measuring devices and requiring a great deal of time. Steelwelds were designed to make this adjustment simple, easy and fast. Hours of work are not required, in fact, the adjustment for any plate thickness can be made in 10 seconds.

Obviously there is no need to shear with some compromise knife clearance setting when you have a Steelweld Shear. You do not have to accept any average cut when with such little effort you can have the best possible cut every time—sharp, straight, accurate with minimum burr. And then, too, remember that knives stay sharp longer when the proper clearance is used.

Easy knife adjustment is only one of many fine features that you will like in Steelweld Shears. For all thicknesses of plate up to 2 inches, for all lengths to 30 feet, you will find Steelwelds have much to offer.

*Write for free copy of Catalog No. 2011.*
*Gives construction and engineering details*

**STEELWELD**

PIVOTED BLADE **SHEARS**

STEELWELD DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 5455 EAST 282ND. ST. • WICKLIFFE, OHIO

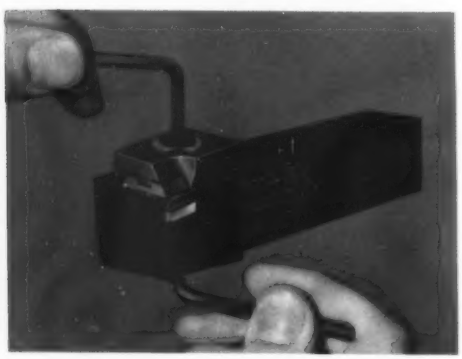
new



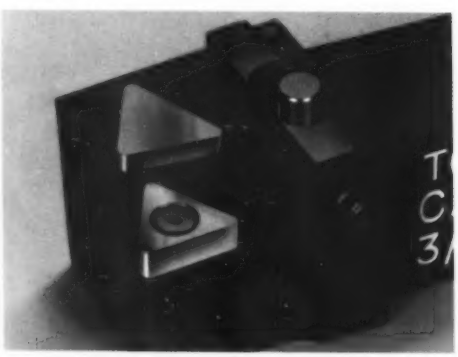
**1. Chipbreaker setting** is adjustable to any width within its range.* Set screw with two open ends provides access from either side. No springs to adjust.



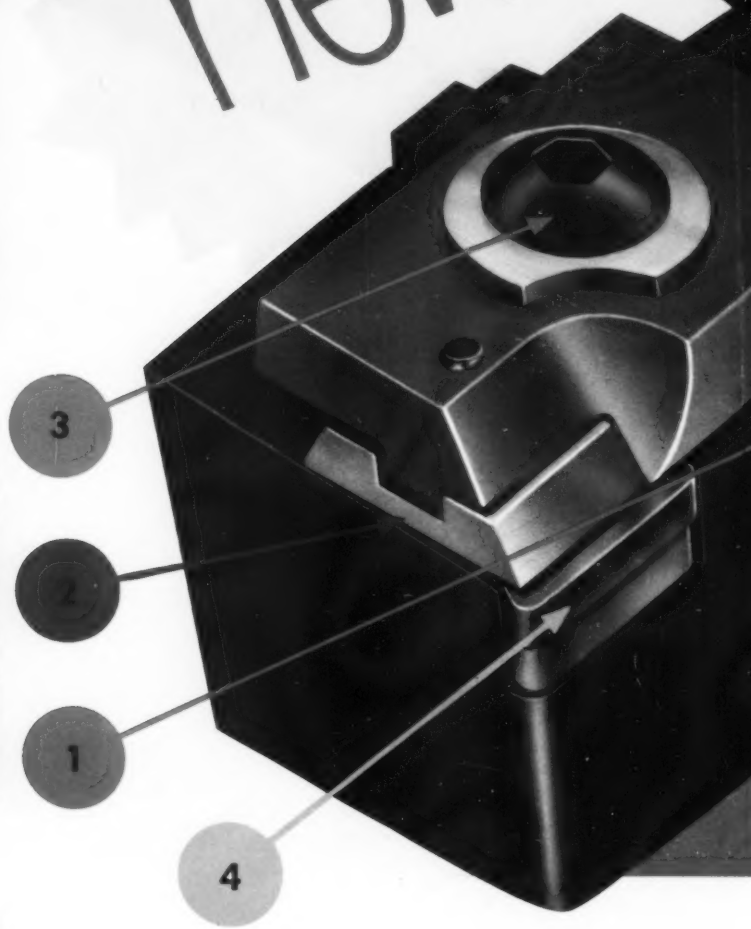

**2. Design permits** absolute repeatability of settings. Floating chipbreaker is indexable. Can't drop out when clamp is loosened.



**3. Clamp screw** is accessible from top or bottom; allows easy indexing or replacement even when toolholder is vertical or upside down.



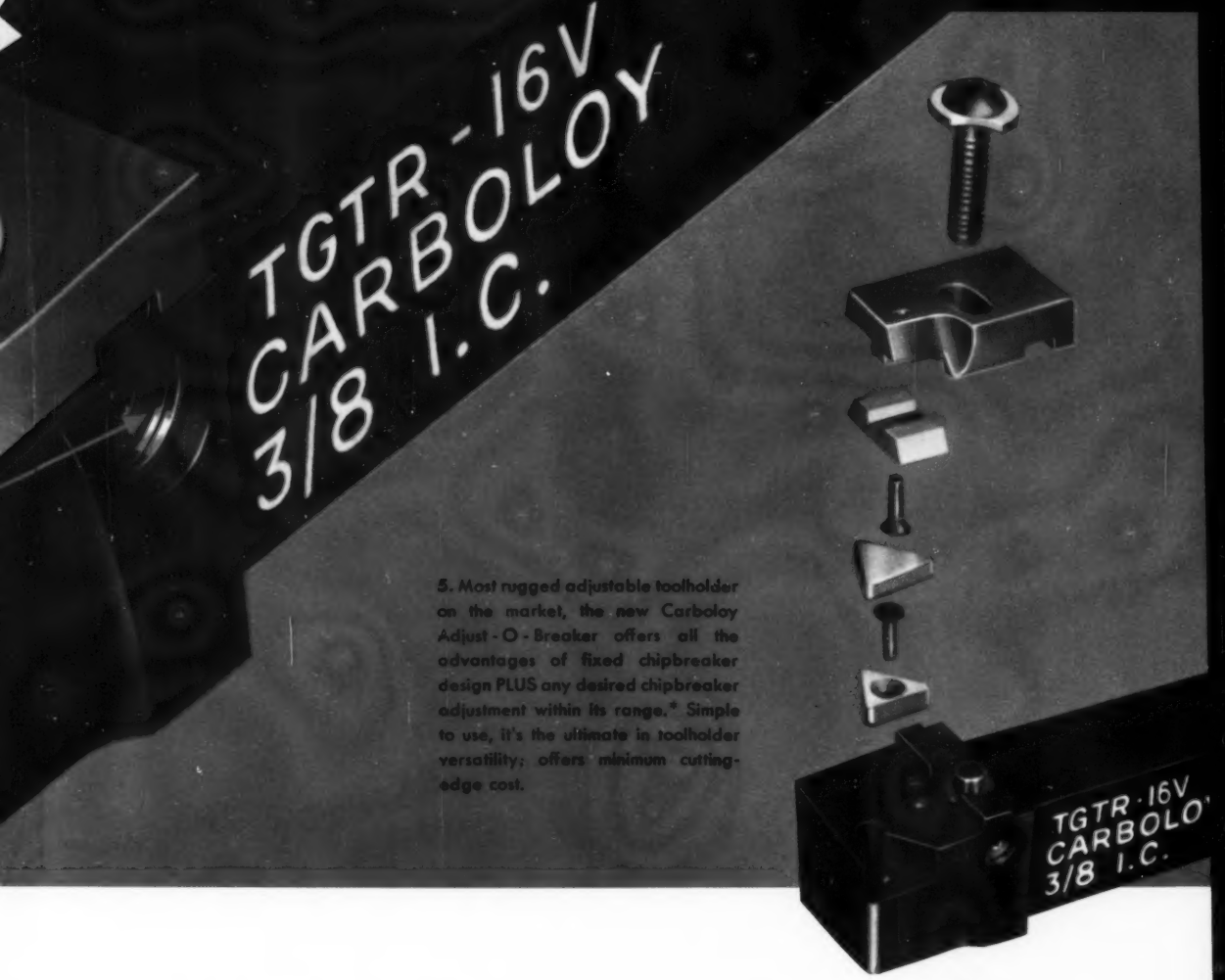
**4. Standard disposable inserts,** Carboloy insert seats and convertible seat are used with toolholder. Insert seats are indexable and self-aligning.




# General Ele
# only Adjust-

**CARBOLOY® TOOLHOLDER WITH ADJUSTABLE CHIPBREAKER LETS YOU ADJUST FROM ANY ANGLE... OFFERS ANY DESIRED ADJUSTMENT WITHIN ITS RANGE*... FEATURES "FLOATING" INDEXABLE CHIPBREAKER WITH ABSOLUTE REPEATABILITY**

*Sizes 16V and 85V: adjustable range 1/16" to 7/32"
Size 20V: adjustable range 1/16" to 11/32"




5. Most rugged adjustable toolholder on the market, the new Carboloy Adjust-O-Breaker offers all the advantages of fixed chipbreaker design PLUS any desired chipbreaker adjustment within its range.* Simple to use, it's the ultimate in toolholder versatility; offers minimum cutting-edge cost.

# ectric announces the t-O-Breaker toolholder

**MORE jobs with LESS tooling**—that's what this new Carboloy Adjust-O-Breaker toolholder means! No need now to have a separate chipbreaker for every cutting job. No need, either, to limit yourself to toolholders with only two or three chipbreaker settings. Now you can have this versatile new Carboloy toolholder and adjust it for *any* chipbreaker setting within its range.*

Available from stock in 5 styles, negative rake, for left- and right-hand machining, the Adjust-O-Breaker holder brings new meaning to disposable tooling.

So, if you want to handle *more* jobs with *less* tooling, look into the complete Carboloy line—Lift-O-Matic (positive rake, negative rake, and tracer), heavy-duty, and the new Adjust-O-Breaker toolholder. Your Authorized Carboloy Distributor can supply you now. Check the Yellow Pages and give him a call today! Or write: *Metallurgical Products Department of General Electric Company, 11173 E. 8 Mile Road, Detroit 32, Michigan.*

**CARBOLOY**
CEMENTED CARBIDES

METALLURGICAL PRODUCTS DEPARTMENT

GENERAL ELECTRIC

AND...

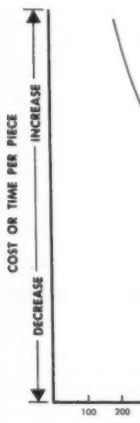
Two great cutting tool developments that mean

# BETTER PROFITS THROUGH BETTER TOOLING

**1** New Carboloy *Adjust-O-Breaker* toolholder lets you handle *MORE* jobs with *LESS* tooling!

**2** *Hi-E* machining results in
. . . lowest cost-per-piece
OR
. . . reduced floor-to-floor time

*Plus* the Carboloy line of disposable and brazed single-point tooling is the *BROADEST* in the industry!



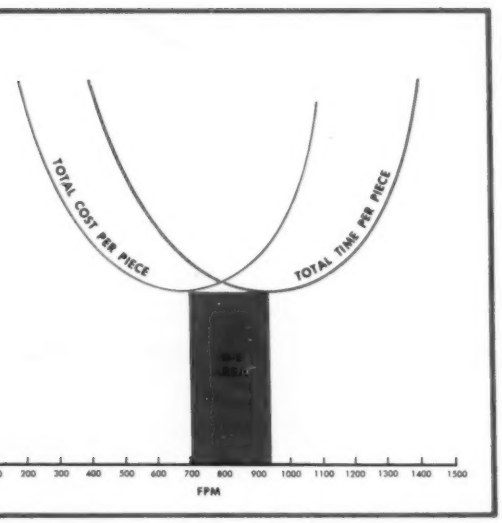

**Hi-E princi**
low points o
efficiency ra

**BRO**

The comp
holders, in
brazed too
designed t
**Make you**
**tooling!** C
Distributo
*Metallurgi*
*Electric Co*
*Michigan.*

*Turn the pages for the full, exciting story!*

# Here's how Hi-E machining pays big dividends... giving you BETTER PROFITS THROUGH BETTER TOOLING




**principle** is illustrated by the curves on this chart. The ints of the two curves mark the boundaries of the high- cy range.

## BROADEST TOOLING LINE IN THE INDUSTRY!

complete quality line of Carboloy tool- rs, inserts, insert seats, convertible seats, and d tooling is the broadest in the industry— ned to meet *every* tooling need!

**your goal better profits through better g!** Check with your Authorized Carboloy ibutor. He's listed in the Yellow Pages. *llurgical Products Department of General ric Company, 11173 E. 8 Mile Road, Detroit 32, igan.*

In the light of current high manpower and equipment costs, carbide tools are low cost by comparison. Profitable operations result from the efficient combination of tool costs, manpower costs, and machine costs. In other words, tool costs should *not* be the only factor in setting up a job . . . rather, most efficient machining methods should be a major consideration. This calls for Hi-E!

Quickly defined, the Hi-E (**Hi**gh-**E**fficiency) machining practice brings together *all* factors to provide a range of cutting speeds for a given job to obtain (1) lowest cost-per-piece machined, or (2) reduced floor-to-floor time. Really, then, Hi-E machining can help you obtain the economical balance between *lowest possible cost* and *greatest possible production rate.*

The Hi-E area (see illus.) shows optimum speeds to obtain this balance. It is represented by an area on the chart between the lowest points on a total-*cost*-per-piece curve and a total-*time*-per-piece curve.

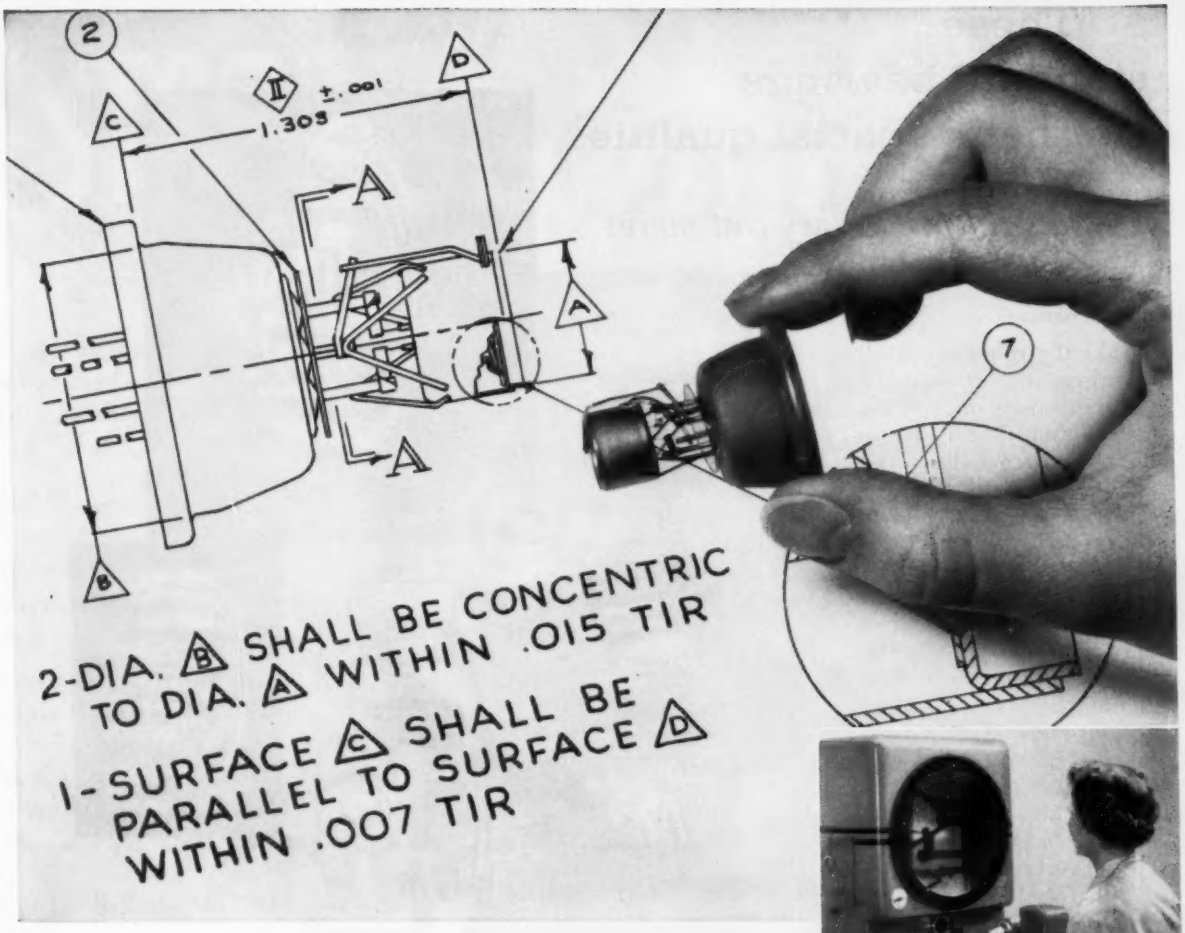
How can *you* employ Hi-E to get BETTER PROFITS THROUGH BETTER TOOLING? Talk it over with your Carboloy representative. He'll be glad to go into detail on Hi-E machining as it applies to *your* operation. Or write directly for your free copy of our detailed Hi-E booklet.

CARBOLOY
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METALLURGICAL PRODUCTS DEPARTMENT

GENERAL ELECTRIC

CARBOLOY® CEMENTED CARBIDES
MAN-MADE DIAMONDS • MAGNETIC MATERIALS
THERMISTORS • THYRITE® • VACUUM-MELTED ALLOYS






# "We can cut out up to 20 gaging operations on delicate parts like this."

"Many times, with a single chart and fixture on our Kodak Contour Projector, we can quickly inspect several complex part dimensions at a single pass. This cuts gaging operations and costs to a fraction of the cost of separate gaging checks," says Varian Associates of Palo Alto, Calif., makers of precision electronic parts and equipment.

*No contamination of or pressure on delicate parts (a light beam exerts no pressure, causes no wear); high-speed, accurate inspection of close-tolerance dimensions; few mechanical operations* . . . these are only some of the reasons why manufacturers like Varian find optical gaging with the Kodak Contour Projector the most practical solution to many inspection problems.

You get more with a Kodak Contour Projector. You get greater *working distance*—8″ of clearance for parts and fixtures. Especially important at high magnifications.

You get more brilliant, more uniform *illumination* over the entire screen area—at all magnifications.

You get highly *accurate images* even at the critical outer edges of the screen area.

You get *upright images* of all inspected parts for easier reference.

These and other features of the Kodak instrument make it more efficient and more valuable to you. Read about them by writing for the booklet, "Kodak Contour Projectors."

**SPECIAL PRODUCT SALES**

**EASTMAN KODAK COMPANY, Rochester 4, N. Y.**

***THE KODAK CONTOUR PROJECTOR***

Kodak
TRADEMARK



For more data, circle this page number on inquiry card

# These standard bearings have special qualities

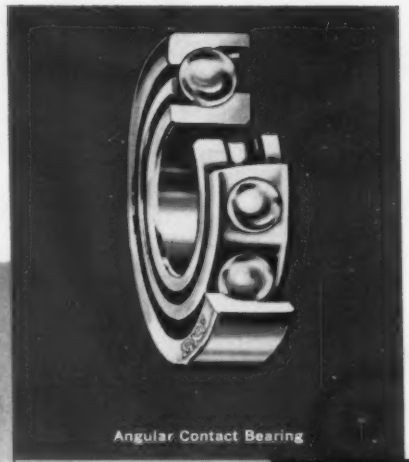
## —*does this mean they cost more?*

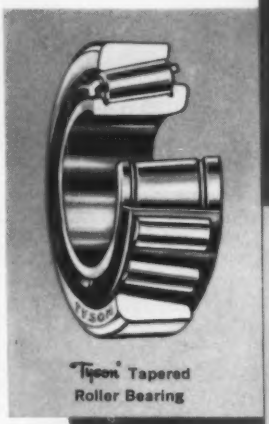
Not necessarily.

*Take the spherical roller thrust bearing, for example. SKF bearings of this type can carry unusually heavy loads: either thrust or combined thrust and radial. Unmatched for single bearing performance when high thrusts must be carried at high speed. And they are completely self aligning. Because of these qualities, engineers choose them for heavy-duty applications over large angular contact ball bearings.

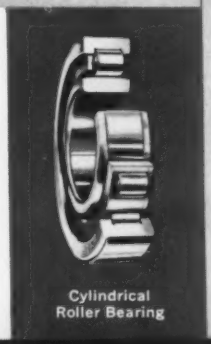
*Yet this standard SKF bearing is competitively priced.* Furthermore, it is promptly available in 25 sizes ranging from 4.3" to 14.9" I.D.

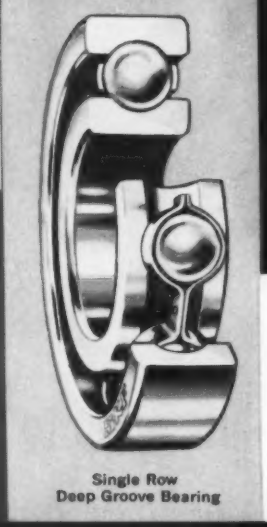
Moderately-priced, high-quality ball and roller bearings are continually rolling off SKF's production lines. So why not get all the facts on those you can use? Just call the nearest of our twenty-five sales offices. 5927


Angular Contact Bearing


"Tyson" Tapered Roller Bearing

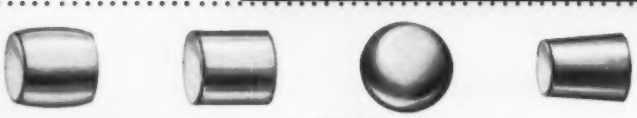

Spherical Roller Bearing


Cylindrical Roller Bearing


Single Row Deep Groove Bearing



*Spherical Roller Thrust Bearing


*Spherical, Cylindrical, Ball, and "Tyson" Tapered Roller Bearings*

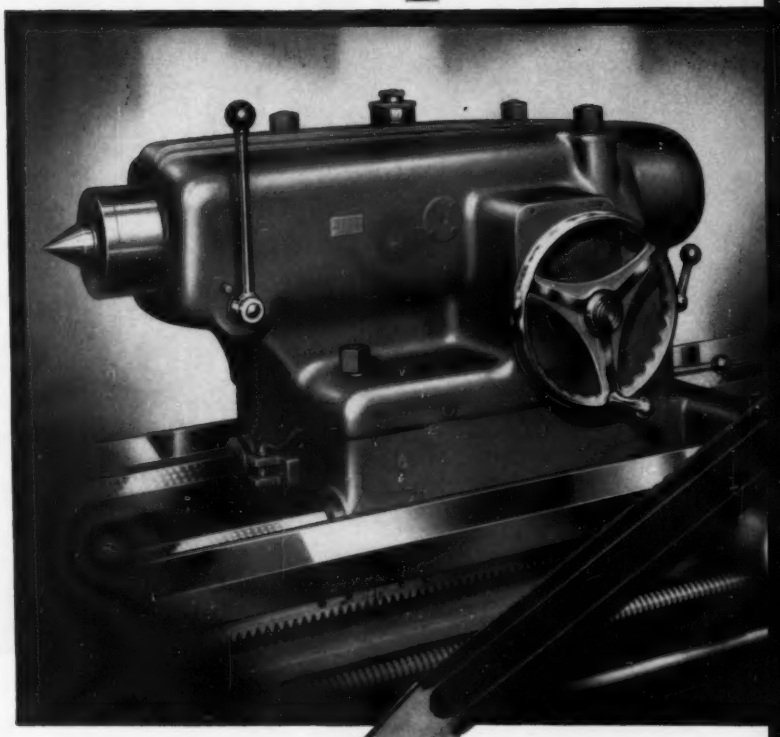
EVERY TYPE—EVERY USE

SKF®

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.

*REG. U. S. PAT. OFF.

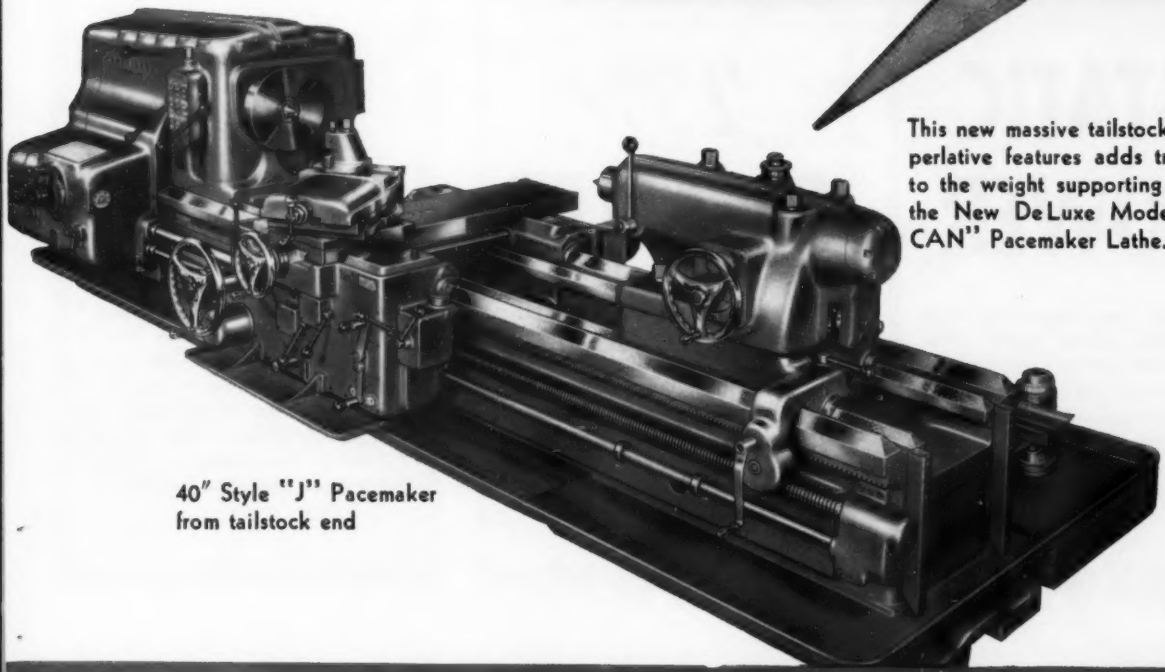
# STOP LOOK Compare



This new mammoth SUPER TAILSTOCK now furnished on "AMERICAN" De Luxe Model 32" Style "I" and 40" Style "J" Lathes has . . .

- 7½" Diameter Spindle—Long Travel
- Unparalleled Rigidity
- Circular Depth Dial—Easily Read
- Built in Single and Two-Speed Types
- Convenient Front Controls
- Either Stationary or Ultra Capacity Built-in Anti-Friction Center
- Both Manual and Power Movement along Bed
- Plunger Pump Oiled including Bed Ways

Send for Bulletin No. 144 for complete details.



40" Style "J" Pacemaker from tailstock end

This new massive tailstock with its superlative features adds tremendously to the weight supporting capacity of the New De Luxe Model "AMERICAN" Pacemaker Lathe.

**THE AMERICAN TOOL WORKS CO.** Cincinnati 2, Ohio, U. S. A.

**LATHES AND RADIAL DRILLS**

# General Electric Announces Newest In The Complete Line Of Adjustable-Speed Drives

**PARMATIC SPEED VARIATOR...newest in General Electric's complete line of packaged adjustable-speed drives . . . provides greater machine flexibility, better quality control, higher output and efficiency.**

## STATIC POWER

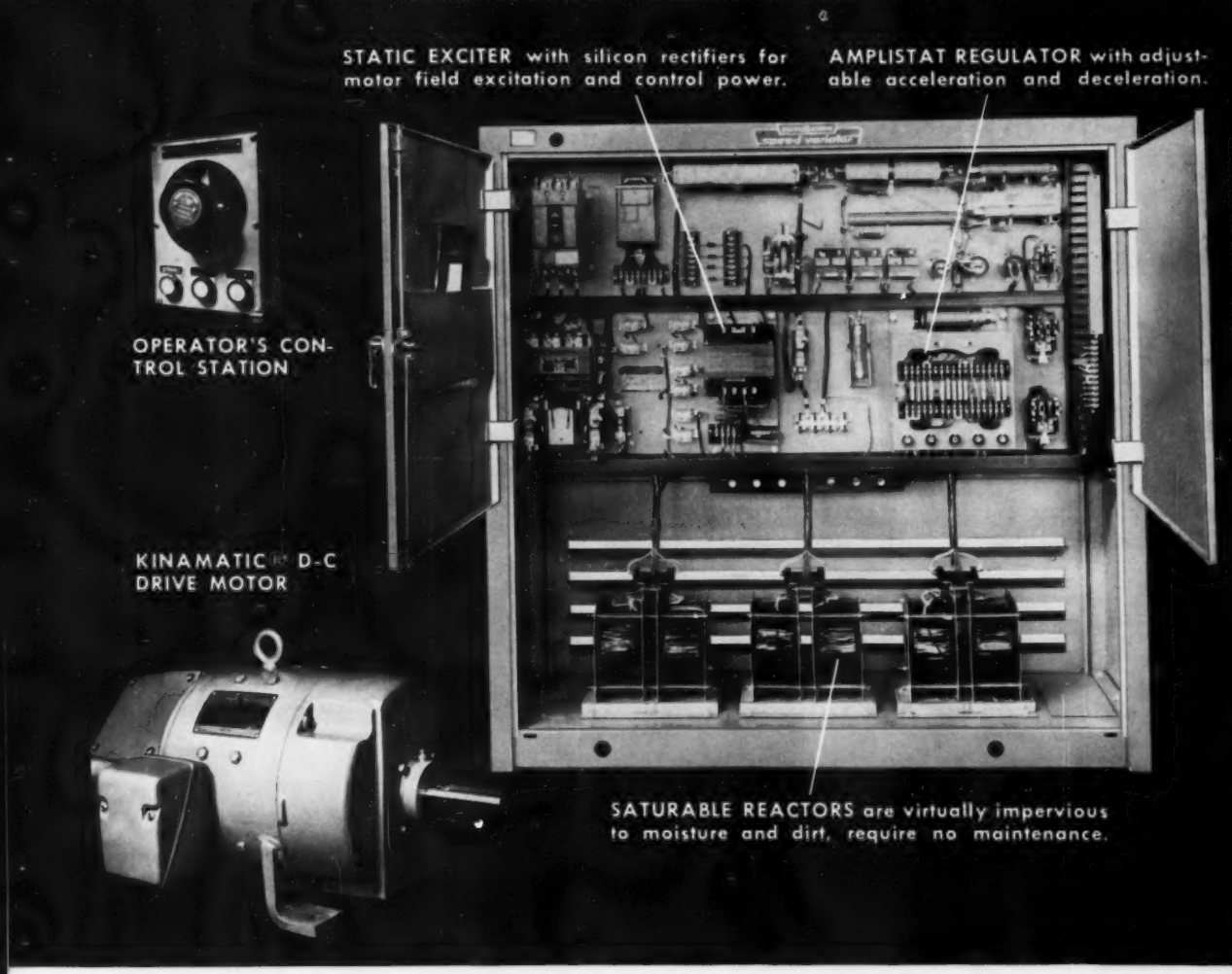
**for less maintenance, less downtime, added profit.** New excitation and power conversion systems have no rotating parts. Sealed silicon rectifiers and saturable reactors need no warm-up, virtually eliminate power unit maintenance.

## 25% SMALLER

**for easier installation.** Reliable, long-life G-E components are factory assembled in compact, space-saving power unit, wired and tested before installation to assure accurate control, reduced installation time and expense.

## 50% LIGHTER

**for lower shipping and handling costs.** New Speed Variator meets industry's demand for lighter, more powerful drives—packs more power, weighs 50% less than other drives of comparable rating, 2000 lbs less in 100-hp ratings.




# FIELD PROVEN

**by two years' impressive on-the-job performance in several hundred installations in 15 industries.** Experience indicates high operating efficiency, lower cost installation and maintenance for a greater return on your investment.

- **GOOD SPEED REGULATION:** 5% with 100% load variation. Closer regulation available with modification.
- **WIDE SPEED RANGE:** Standard Parmatic Speed Variator provides 8 to 1 range or wider if required.
- **RESISTS CONTAMINATION:** Saturable reactors and hermetically sealed rectifiers resist dirt and moisture.
- **QUIET AND VIBRATIONLESS:** New power unit design eliminates noise and vibration—expands drive versatility.

**Limitations:** G-E Kinamatic Speed Variator with motor-generator set is recommended for applications requiring power absorption for stopping or overhauling loads. *For more information*, call your General Electric Sales Engineer, or write for GEA-7012, Section 821-1, General Electric Company, Direct Current Motor and Generator Department, 3001 East Lake Road, Erie, Pennsylvania.

GENERAL ELECTRIC



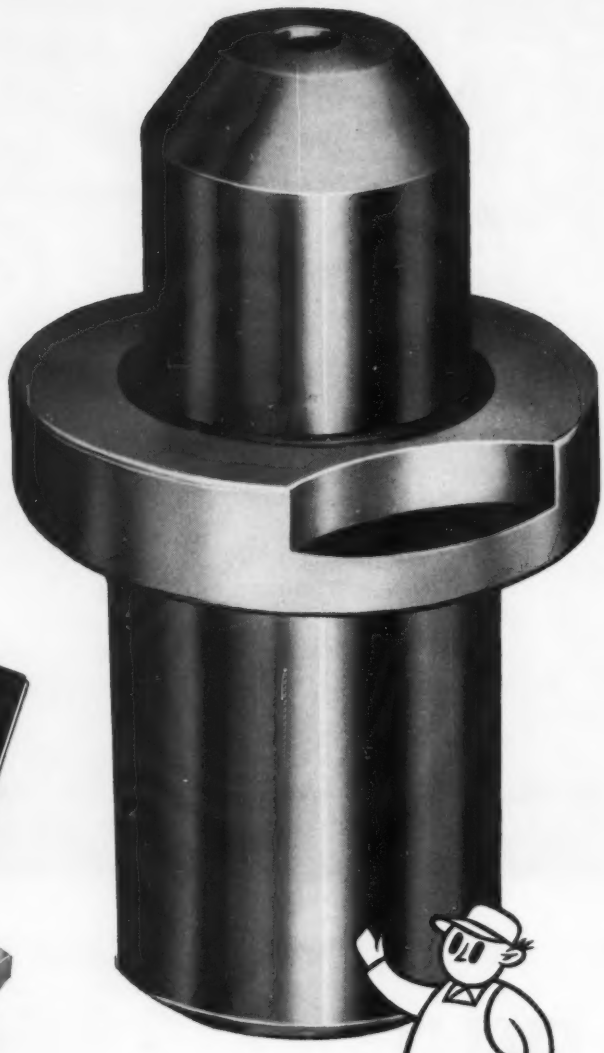
For more data, circle this page number on inquiry card

# FOR ACCURATE LOCATING USE UNIVERSAL LOCATING PINS

Universal Locating Pins assure quick, accurate locating throughout even the longest production runs. They're hardened and ground to extremely close tolerances . . . precision made to give long service life for much less than the cost of ordinary tool-room pins.

Press fit, threaded or lock-screw types, round or relieved, are stocked in all standard sizes for immediate delivery. Write for catalog detailing locating pins plus other Universal production tools.



Lock Screw Pin





Relieved Press-Fit Pin



Threaded Pin

212

## OTHER PRECISION-BUILT COST SAVING UNIVERSAL PRODUCTION TOOLS



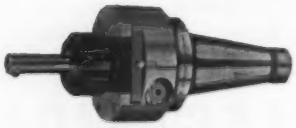
Floating Chuck



Standard Collet Chuck



Mikro-Lok Boring Bar



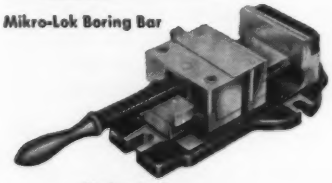
Boring Chuck



"Kwik-Switch" Tool Holder



Standard Drill Bushing



Wedge-Lock Production Vise

**UNIVERSAL ENGINEERING COMPANY,** FRANKENMUTH 2, MICHIGAN



New ROL-PAK slips over dispenser rail, tape strips off in seconds. Printed, color-coded tapes identify ring type and size. All or part of ROL-PAK may be used at one time.

TIME EXPOSURE COMPARISON



Old stack-rod set up requires two hands. Uses up valuable production time.



New ROL-PAK set up is far simpler and quicker; requires only one hand.

# New Truarc ROL-PAK speeds ring assembly, handling

ROL-PAK* is a new method of pre-stacking retaining rings for faster, more economical assembly on production lines. Pre-stacked on a color-coded tape, the rings are quickly identified by type and size. Available to users of Truarc Retaining Rings exclusively, ROL-PAK provides production flexibility, and allows faster and more efficient assembly set-up.

On your production line, ROL-PAK slips over the dispenser rail ready to use. The pressure sensitive tape is stripped off in seconds. With the old stack-rod packaging, by contrast, an operator had to remove the cotter pin, hold the bottom rings on the rod to prevent their slipping off then carefully position the rod on the dispenser rail . . . a much more time consuming, less-efficient method.

Here are important ROL-PAK advantages for you to consider: *Faster assembly* because of quicker, easier loading as illustrated above. *Easier identification* of ring size and type, right on the printed, color-coded tapes. *Greater flexibility* since all or part of ROL-PAK may be used. *Easier handling, storage* with no protruding stack-rods.

ROL-PAK is available in Truarc Series 5103 Crescent® rings, 5133 E-rings and 5144 Reinforced E-rings in most widely used sizes. All present types of Truarc ring dispensers may be easily converted to ROL-PAK.

The design advantages of Truarc retaining rings, have led to their ever increasing use in production of products of all kinds. The new Waldes Truarc Assembly Tool Catalog AT 10-58 covering assembly tools, pliers, applicators, dispensers and grooving tools belongs in your files—write for it. And on special application problems, Waldes Truarc engineers will be glad to help. Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, N. Y.

*Pat. Pending ©1959 WALDES KOHINOOR, INC. 9-10



WALDES
TRUARC®
RETAINING RINGS
Waldes Kohinoor, Inc., Long Island City 1, N. Y.

TRUARC RETAINING RINGS...THE ENGINEERED FASTENING METHOD FOR REDUCING MATERIAL, MACHINING AND ASSEMBLY COSTS

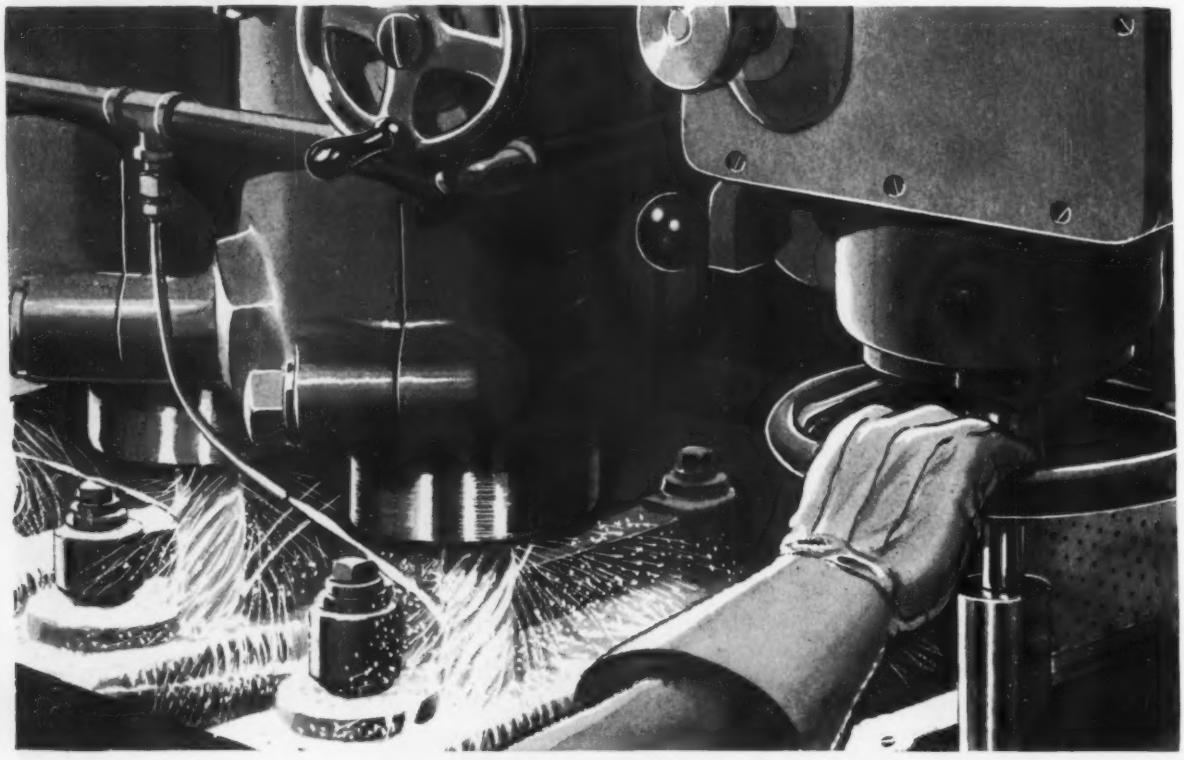


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*For top economy in oil-water lubricants*

# ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 FIELD SERVICE MEN • OVER 160 MATERIALS



## Oakite Formula 59 cutting solution fights rancidity . . . lasts longer

Most soluble oil cutting solutions are thrown out before they're worn out. When they turn so rancid that operators can't stand the smell, they're replaced. Understandable . . . and wasteful. But using Oakite 59 is far more economical. It *resists* rancidity, lasts far longer—especially in summer, helps protect workers from infection, cuts cost.

How well does it lubricate? Specially formulated from paraffin crude, it forms a stable, uniform emulsion in water for excellent lubrication, good cooling, corrosion protection for work and machine alike.

One of a line of Oakite lubricants for machining and forming, Oakite Formula 59 is a specialized material—as all Oakite products are. Ask the Oakite man about those designed for your operations, your products. And send for Bulletin A-9864. Oakite Products, Inc., 26 Rector Street, New York 6, N. Y.

*it PAYS to ask Oakite*

OAKITE

50 1909-1959 SCIENCE

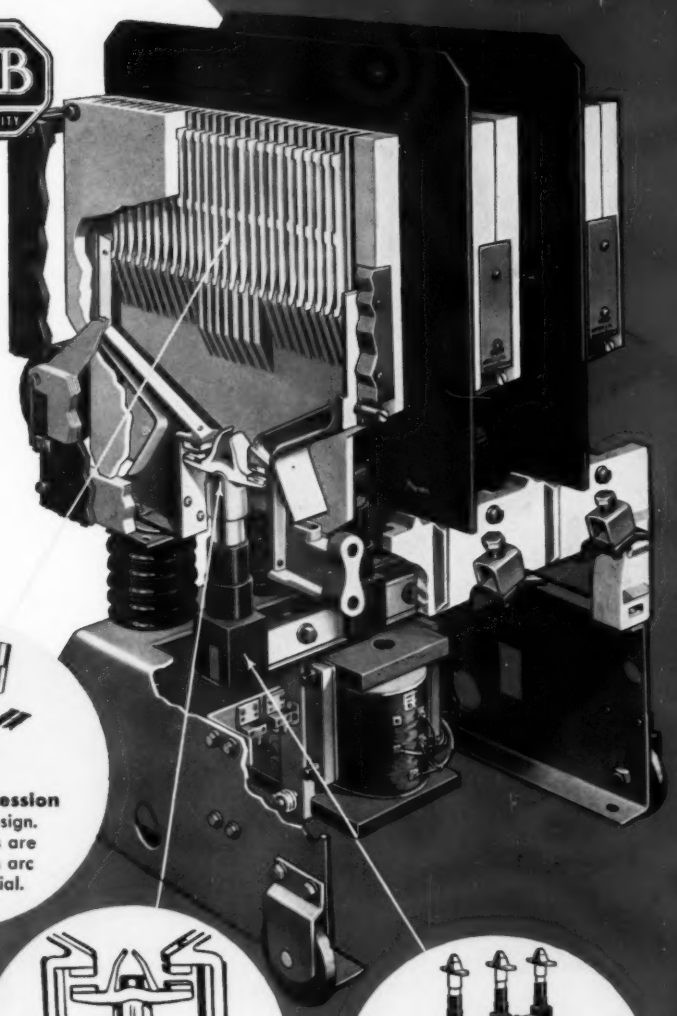
*years' leadership in industrial cleaning*



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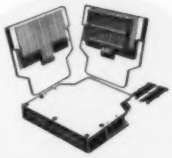
Here's the inside story of industry's

# MOST RUGGED HIGH VOLTAGE SWITCH



**THIS SOLENOID AIR BREAK CONTACTOR IS THE HEART OF THE A-B STARTER LINE**

A tremendous operating life has been built into these new A-B high voltage, air break starters by using the same simple solenoid design—with only ONE moving part—that has proved good for millions of trouble free operations in Allen-Bradley low voltage starters. A-B high voltage starters are made for all types of service and for all types of motors up to 1500 hp, 2300 v; 2500 hp, 4600 v. Send for Publication 6080, today.



**Faster Arc Suppression**
New blowout design. Novel arc chutes are molded from an arc resistant material.

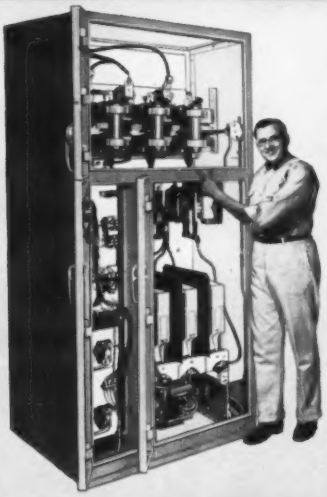


**Double Break Contacts**
Silver alloy contacts never need maintenance. Vertical motion assures uniform contact pressures.



**Only One Moving Part**
Simple solenoid design eliminates trouble-causing pins, pivots, and flexible jumpers.

8-59-RM



**A-B High Voltage Starter with Air Break Contactor**

Bulletin 1159 high voltage air break, across-the-line induction motor starter in NEMA Type 1 enclosure. All Allen-Bradley high voltage starters are equipped with current limiting fuses with interrupting capacities of 150,000 kva at 2300 v; 250,000 kva at 4600 v.

# ALLEN-BRADLEY

Member of NEMA

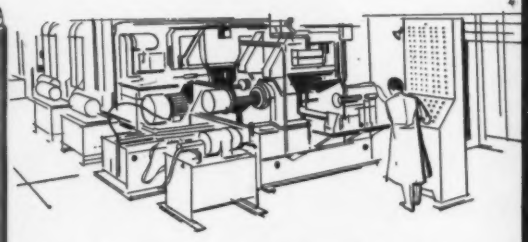
*Quality* Motor Control

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

# AUTOMATION BEGINS HERE

*. . . Insist on Allen-Bradley accessories for continuous automatic production*

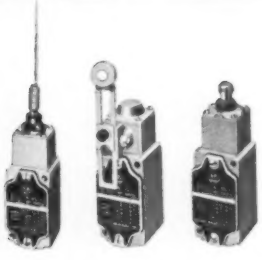


In this broad line of Allen-Bradley accessories, each and every unit carries the traditional A-B trademark of *quality* that stands for trouble free operation. Rugged construction, and maintenance free, silver alloy contacts provide the reliability that is essential to the continuous operation of *your* automatic production machines.

Profit from the experience of the leading machine tool builders . . . insist on Allen-Bradley *quality* motor control *all the way!*

▲ Special push button panels can be assembled to your specifications.



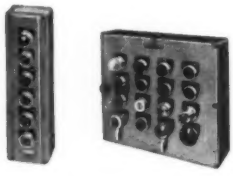
**OILTIGHT LIMIT SWITCHES**
Bulletin 802T with sealed heads and bodies. Various operators.



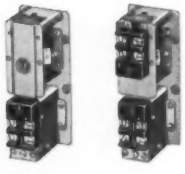
**PRECISION LIMIT SWITCH**
Bulletin 802 oiltight. Responds to very small operator travel.



**OILTIGHT CONTROL UNITS**
Bulletin 800T. Choice of push buttons, lights, and switches.



**OILTIGHT CONTROL STATIONS**
Bulletin 800T for up to 16 units in die cast aluminum enclosure.



**PNEUMATIC TIMERS**
Bulletin 849. Reliable and accurate. For on-delay or off-delay.



**OILTIGHT PRESSURE CONTROL**
Bulletin 836. For hydraulic systems with pressures to 5000 psi.



**STANDARD DUTY PUSH BUTTONS**
Bulletin 800. Up to three units, also pilot lights and switches.



**FOOT SWITCH**
Bulletin 805. In rugged die cast housing for toughest service.

8-59-RM

# ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

***QUALITY MOTOR CONTROL***



# "Our Goal is an Annual Facilities Program Which Will Result in the Greatest Return For the Expenditure Made"

**ROBERT G. ALLEN**

**PRESIDENT**

**BUCYRUS-ERIE COMPANY**

**South Milwaukee, Wisconsin**

"The Bucyrus-Erie Company, a leading producer of excavating and drilling equipment, has entered into a comprehensive program to obtain the maximum profit from the use of its invested capital. An important aspect of this program involves taking a careful look at opportunities that occur to invest funds in new and better facilities. This includes facility replacements due to obsolescence or wear, as well as the necessary requirements to expand or balance capacities.

October, 1959

Information is provided in the form of:

1. A plain "Pay-Off" period
2. The return on investment (based essentially on the new MAPI formula)
3. An urgency rating arbitrarily made by the division originating the request for investment

With this information at hand, management can then make a decision based on the availability and cost of funds.

A thorough post-audit on each project is part of the program which is designed to keep us "on the track."

Our goal is an annual facilities program which will result in the greatest return for the expenditures made."

**Keep Gathering Metal-Working Production Ideas . . . Be well informed when you replace machinery.**

**ROCKFORD INSERT GROUP**




# New BARNESDRIL HONING MACHINE

FEATURES:
- INFINITE HONE FEED ADJUSTMENT
- SHORT-STROKING AT ANY POINT IN BORE
- REMOTE-CONTROL HONE TOOL ADJUSTMENT

This new Barnesdril No. 244 Honing Machine represents a completely new design in honing equipment, including many added features for increased efficiency and flexibility.

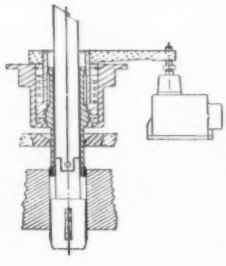
Most noteworthy advantage is the new electric hone expansion which provides infinitely adjustable hone feeds with remote honing tool adjustment. This system eliminates all tubes and rectifiers usually found with electronic controls. Less headroom is needed because the cylinders are housed within the column. The external electric cabinet has been removed and electric controls have been built-into two side panels on either side of the column. Set-up controls are protected by lock and key. With a new accurate reversal stroke, the machine short-strokes at any point in the bore, and is suited particularly for honing ported bores.

Get full details on this new honing machine from your local Barnesdril representative, or write for new bulletin No. 550.



New also in the Barnesdril line is the Model No. 10 Honing Machine, for fast, economical finishing of bores ¼" to 1½". This machine may also be fully automated for fully automatic production lines.

For Controlled Finishing with Consistently Close Limits of Accuracy and Rapid Stock Removal, Use Barnesdril Honing Equipment.



All Barnesdril honing machines provide outstanding accuracy through Plugmatic bore-to-bore sizing, which is a system gauging only on the bore diameter itself. Size is consistently maintained within .0002"

**BARNES DRILL CO.**

850 CHESTNUT STREET • ROCKFORD, ILLINOIS

DETROIT OFFICE: 13121 Puritan Avenue

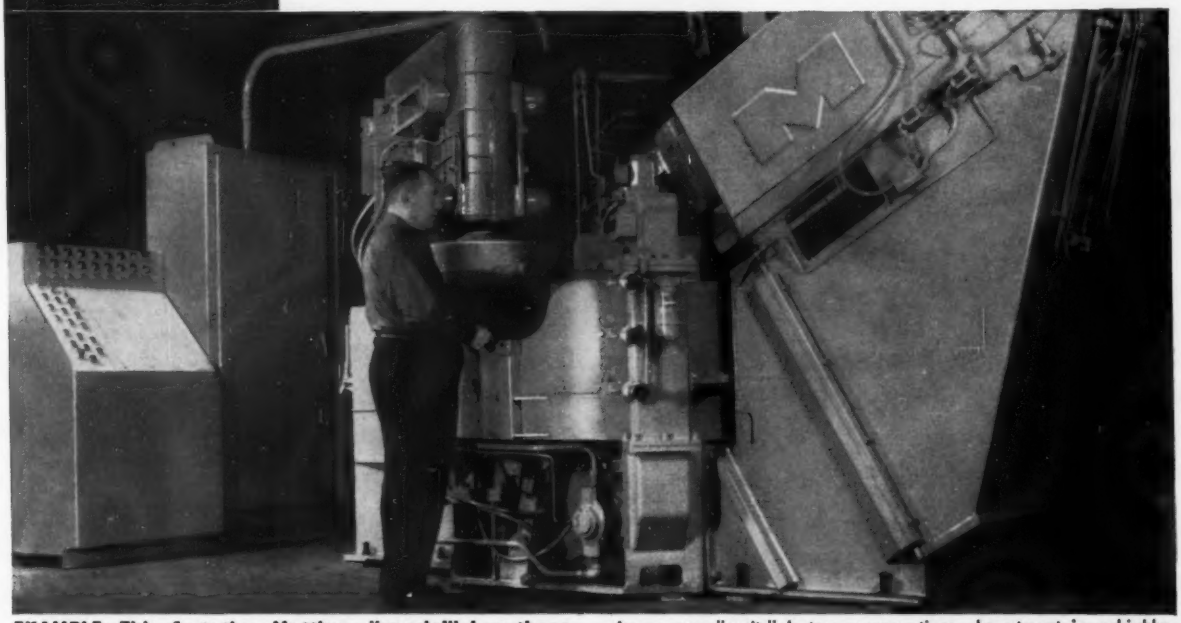


CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

MATTISON
HIGH-POWERED PRECISION
**GRINDING METHODS**

# Machining competitively priced parts?

## Consider the unexplored opportunities to save with special, multiple-operation grinders!



**EXAMPLE: This 4-station Mattison "special" has three work stations,** plus a load and unload station, for completely automatic grinding of head bearing sections for rock bits. The workpiece never "waits" between operations. Investment in a highly automatic special machine is long-range assurance against obsolescence and competitive disadvantage.

If your parts are competitively priced, perhaps you can save a great deal of time, floor space, and cost by combining a variety of grinding operations into a package.

An example is this special four-station Mattison grinder for rough- and finish-grinding the head bearing sections of rock bits. The work package consists of: surface-grinding the top of the bearing pin, rough-grinding the pin diameter and adjacent shoulder, chamfering the pin, and finish-grinding the pin diameter and shoulder.

Size is controlled automatically by gages which reset the grinding wheels to compensate for wheel wear. The entire machine cycle is automatically controlled. The operator's console is equipped with indicator lights that provide a visual record of work status.

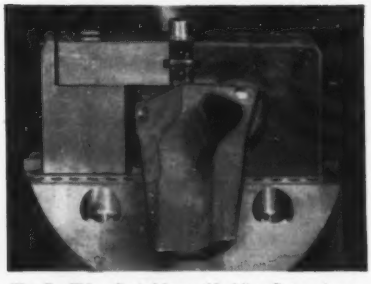


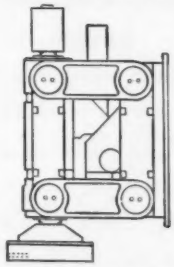
**Fig. 1**—This adjustable workholding fixture is easily adapted to a variety of pin sizes, from 3½ in. to 9⅞ in. Work shown is in the load-unload station.

Despite the fact that this is a high-production machine, it has considerable flexibility and can handle parts for bits ranging from 3½ in. to 9⅞ in. sizes. Adjustable fixtures (Fig. 1) adapt the grinder to a relatively wide range of work.

### Parallelogram head

The Mattison patented parallelogram head is used at station No. 2. Advantages of this design include: completely sealed, preloaded bearing journals; elimination of play commonly developed in conventional tool slides; and all mechanisms completely sealed to exclude grinding dust and/or coolant.

The parallelogram head on this machine features hydraulic feed working against an adjustable lead screw stop; and both rapid approach and fine feed strokes, with controllable feed rates and adjustable limits. The lead screw features a variable increment infeed, making the head ideally suited for cycling operations and automatic size control systems.



Somewhere in the variety of cylindrical and surface grinding operations in your plant, there may be (and probably is) enough work and high volume to justify special, multiple-operation grinders. Why not investigate these opportunities and give your plant a chance to be different from, and better than, your competitors who rely on "conventional" machining methods. It won't cost you anything to find out—just pick up your phone and call:

**MATTISON MACHINE WORKS**
**Rockford, Illinois  Phone 2-5521**

***Want more information?***
Send for bulletin describing variety of Mattison "special" grinders for high-production machining.



MATTISON MACHINE WORKS

**HIGH-POWERED PRECISION SURFACE GRINDING**



CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



SUNDSTRAND *"Engineered Production"* NEWS

# Cut milling costs with standard Rigidmils* and Sundstrand "Engineered Production"

Determining the most profitable processing method, then selecting the machine to suit this method — that's Sundstrand "Engineered Production" at work.

To offer full benefit of the most profitable method, Sundstrand builds a wide range of standard machines as well as semi-standard and special machinery. From Sundstrand's extremely wide choice in table sizes, strokes, spindle speeds, horsepowers, controls and basic elements, you can get a standard machine with customized features for your particular job — yet one that can be readily converted to other jobs.

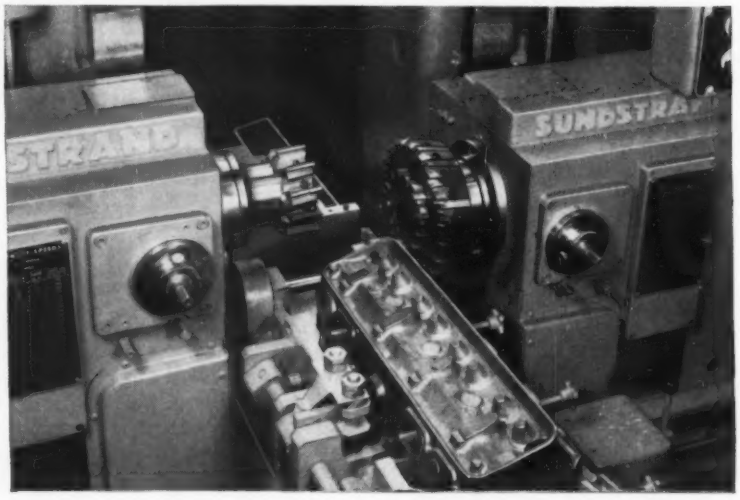
Sundstrand Rigidmils have been tooled in many ways to lower production milling costs. A few typical examples are shown. Countless plants using Sundstrand machines with "Engineered Production" methods and accessories have found them productive and economical. Call in a Sundstrand engineer to assist you with your milling problems. There is no obligation for this service.





**Triplex Rigidmil**

Two opposed side pads and one top pad are milled simultaneously on differential carrier parts with this triplex type Rigidmil. Vertical adjustment of side heads, endwise adjustment of spindles, and easily adjusted table feed stroke provide machine flexibility for future change in part sizes.




**Duplex Rigidmil**

Ten locating and transfer pads on opposite sides of cast iron cylinder heads are milled simultaneously, using carbide cutters. Output is approximately 28 parts per hour.

***Milling Machines**

Learn more about the application of Sundstrand "Engineered Production" to the solution of your milling problems by writing today for Bulletin 608.




*"Engineered Production" Service*

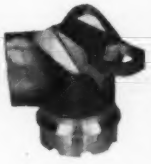
SUNDSTRAND

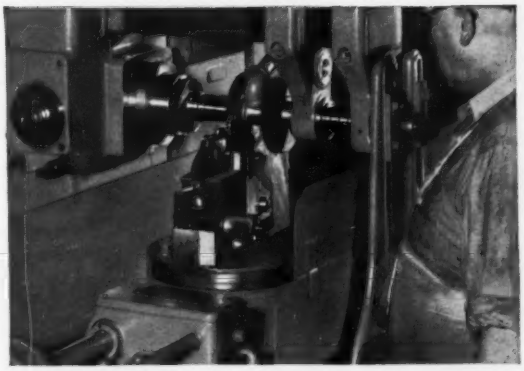


MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

## Simplex Rigidmil

Straddle milling both sides of stainless steel fuel nozzle, one at 140° and the other at 166°, and mounting work in dual fixture on an automatic index base boosted production materially. One side of the fixture is unloaded and reloaded while cuts are taken at the other side to make loading time free.

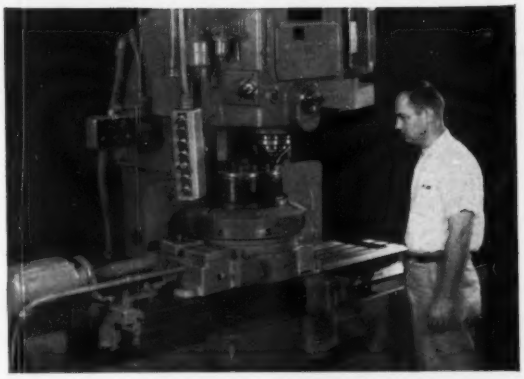




## Vertical Rigidmil

Machining time was reduced 82% in milling 28 scallops on the periphery of a steel housing, when put on this standard vertical Rigidmil with a standard automatic index base attachment. Cycle is completely automatic including indexing. Operator only loads and unloads fixture.

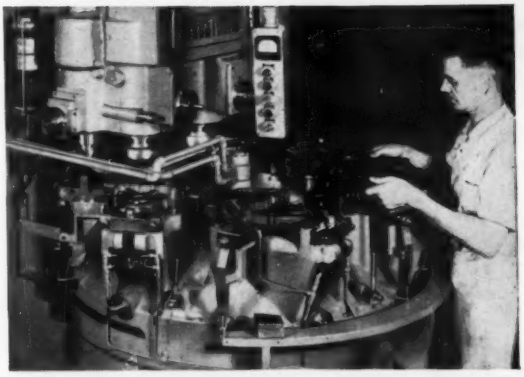




## Rotary Milling

This Rigidmil with rotary table makes possible a continuous milling cycle. Loading and unloading time is eliminated—operator loads and unloads while cuts are in progress. Machine shown has multiple spindle head so that ruff and finish cuts can be made with one locating and clamping of the workpiece.





## Tracer Equipped Rigidmil

This Sundstrand C-5 Rigidmil equipped for tracer milling lost no time in effecting major savings when put on the job machining tool steel. Savings up to 75% over previous methods were made on the many different parts now run over this machine. Easy setup for various parts changes provided additional benefits.



# SUNDSTRAND MACHINE TOOL

DIVISION OF SUNDSTRAND CORPORATION

BELVIDERE, ILLINOIS

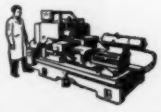
SUNDSTRAND

*More facts about*

**SUNDSTRAND**

*"Engineered Production"*

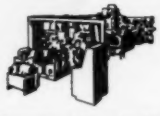
Literature listed under various machine types has more details. Write Sundstrand for your copy today.



Automatic and Tracer Lathes
Bulletin A-108



Engineered Milling Production
Bulletin B-108



Examples of Transfer Machines—Bulletin C-108



Multiple-spindle Drilling Machines—Bulletin D-108



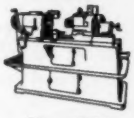
Internal and Rotary Surface Grinders—Bulletin E-108



Broaching Tools
Bulletin F-108



Practical Broaching Methods
Bulletin F-108



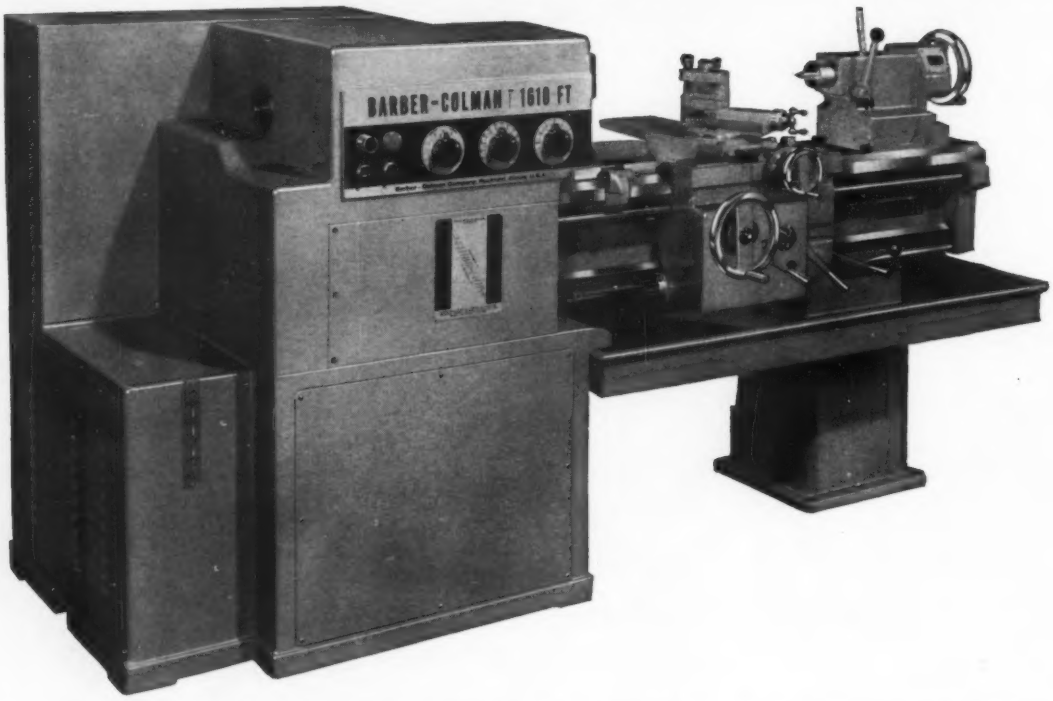
Thread Milling
Bulletin G-108



CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



# New Facing and Turning Lathe




A high percentage of lathes equipped with threading features are used exclusively for turning and facing. What's more, many long-run turning jobs require toolroom accuracies nowadays. So, why pay a premium for threading when you can buy a rugged, high-speed lathe that is a "cut above" other machines in the same price range?

Generally, there are only two kinds of lathes designed especially for turning and facing. Those with a belt drive (like our 1610 FT) and those with a geared head. Now, a geared head lathe is fine. We make lots of them. But, for fast, fine-finish turning, most people prefer a belt drive — and it's exceptionally quiet. (For heavy cuts at low speeds, a back gear reduction of 4.4:1 is available as extra equipment.)

### Infinitely variable speeds and feeds

The 1610 FT is powered by a timing belt drive from a 6.5 horsepower variable speed motor. We can furnish 1500, 2000, or 2500 rpm maximum spindle speed to put you in the carbide-ceramic ranges. Like our No. 2-E, this new facing and turning lathe changes speeds "on the fly" . . . with the tool in the cut, by the turn of a dial on the headstock.

For consistent accuracy and long tool life, you'll want an easy, practical method of adjusting feed. Power feed to both carriage and cross slide is infinitely variable from .079″ to 24″ per minute. There are no feed gears to shift — just an easy-to-turn dial on the headstock. Depending on the spindle speed, feeds from .00003″ to .482″ per revolution of the spindle are possible. For tracer work or large facing cuts, a constant sfm control is available as extra equipment.

### A few words about quality and price . . .

The new No. 1610 FT is not a stripped-down model but a lathe designed to meet modern toolroom and production methods. A sizable reduction in price over a standard lathe results from having designed a lathe specifically for turning, facing, and boring. It's a precision machine (with the same toolroom "feel") as all Barber-Colman toolroom lathes . . . a machine any owner will tell you is the outstanding value in its class. The completely ground spindle is mounted on precision tapered roller bearings, equipped with automatic thermal compensation to maintain a constant bearing load. Automatic feed stops and a positive micrometer stop are standard. There's a spindle speed tachometer on the headstock, and a counter on the tailstock to indicate quill travel to .001″. Difficult-to-read scales have been eliminated. All dials on the carriage and compound are direct reading. Dynamic brake is fast, yet smooth for heavy workpieces. It has no moving parts.

### Other features available . . .

Ask your Barber-Colman representative or dealer for complete facts and features on this new, practical kind of lathe. It may be just what you need for your turning and facing requirements.

**Barber-Colman Company**

BARBER COLMAN®

**102 Loomis St., Rockford, Illinois**



CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

Carl:
This sounds like what we've been looking for. Suggest you investigate
JC

# COOPERATIVE CREATIVE-ENGINEERING




## • COOPERATION IN IDEAS

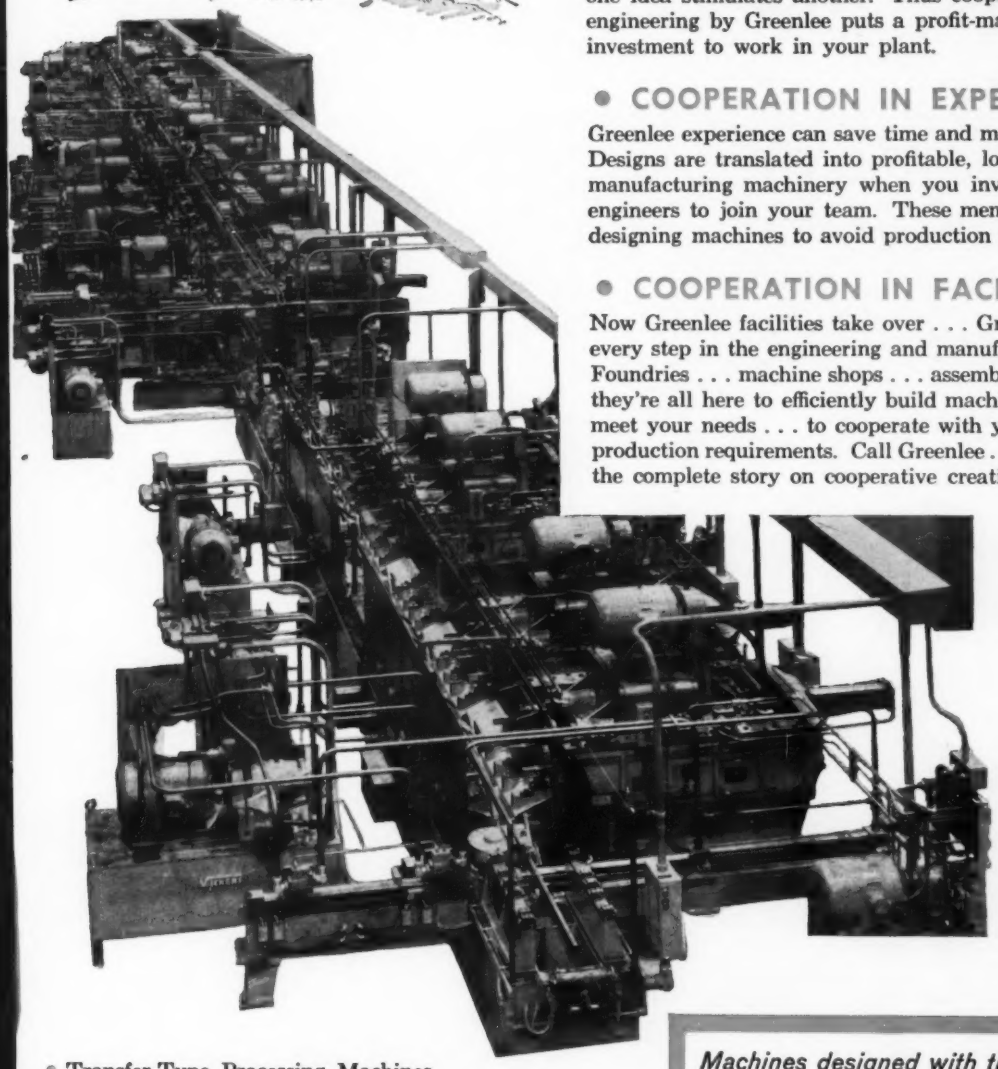
Greenlee engineers work with your men at all levels of management, production, and engineering. They gather and exchange information based on broad experience. These contacts accelerate creative thinking . . . one idea stimulates another. Thus cooperative creative-engineering by Greenlee puts a profit-making investment to work in your plant.

## • COOPERATION IN EXPERIENCE

Greenlee experience can save time and money in your plant. Designs are translated into profitable, low-cost manufacturing machinery when you invite Greenlee engineers to join your team. These men know the art of designing machines to avoid production problems.

## • COOPERATION IN FACILITIES

Now Greenlee facilities take over . . . Greenlee controls every step in the engineering and manufacture of machines. Foundries . . . machine shops . . . assembly floors . . . they're all here to efficiently build machines to meet your needs . . . to cooperate with you in meeting production requirements. Call Greenlee . . . let them give you the complete story on cooperative creative-engineering.



PRODUCTION MACHINES
GREENLEE

Miss Jones:
write for available literature and mail this to Joe Thompson
C.F.

- Transfer-Type Processing Machines
- Multiple-Spindle Drilling and Tapping Machines
- Six and Four-Spindle Automatic Bar Machines
- Die Casting Machines and Trim Presses
- Hydro-Borer Precision Boring Units
- Core Box Handling Equipment for Foundries
- Specialized Woodworking Machines
- Hand Tools for Woodworking
- Tools for Woodworking Machines
- Hydraulic Tools for Electricians, Plumbers, Contractors

*Machines designed with the future in mind*

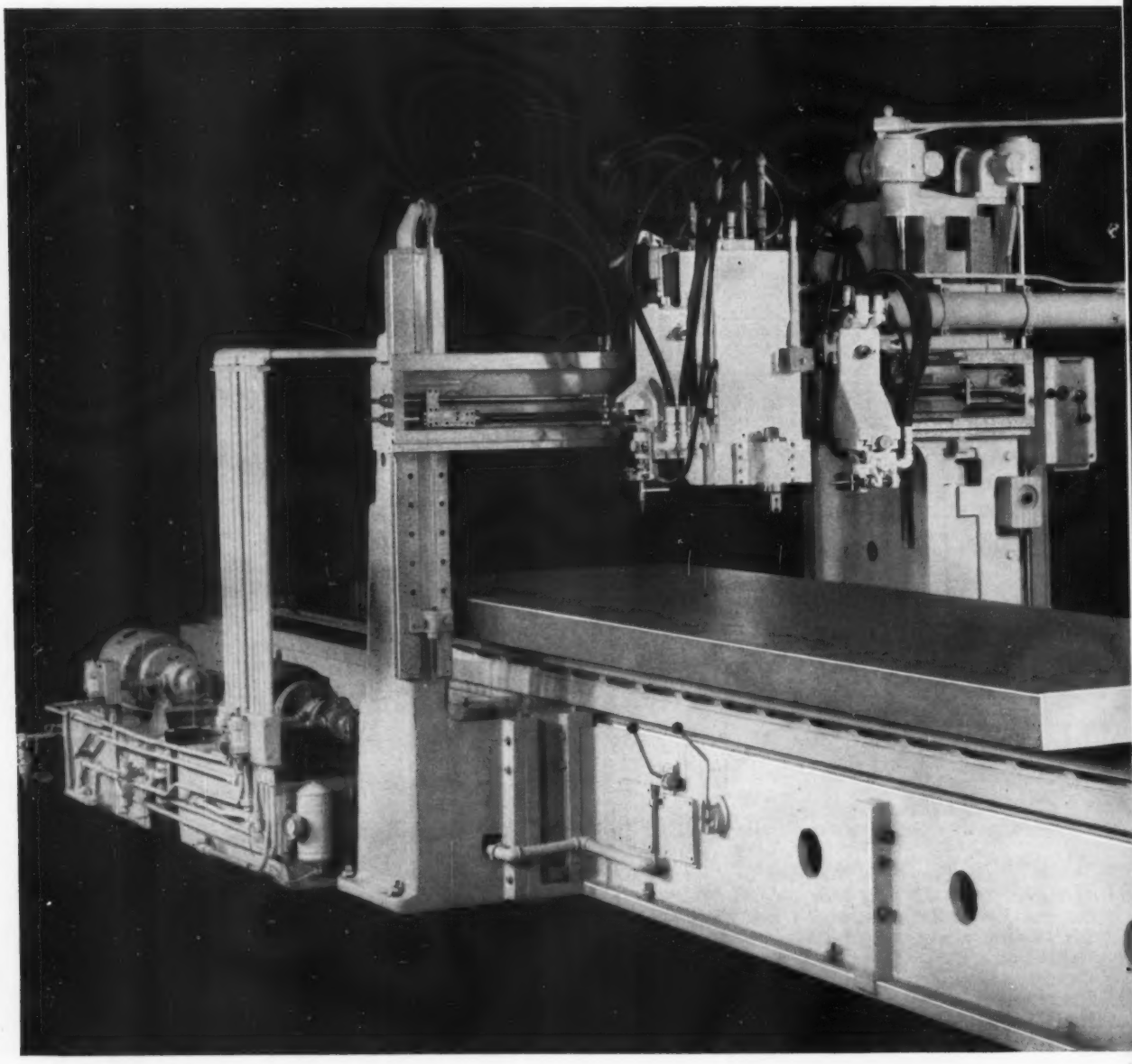
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CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



# Nothing does the job like a.





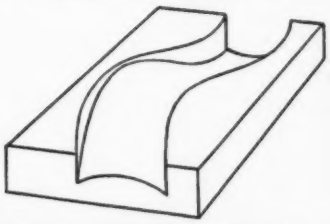
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HYDRAULIC

# TRACER-PLANER

MACHINES COMPLICATED CONCAVE-CONVEX AIRCRAFT PARTS IN ONE-TENTH FORMER PRODUCTION TIME



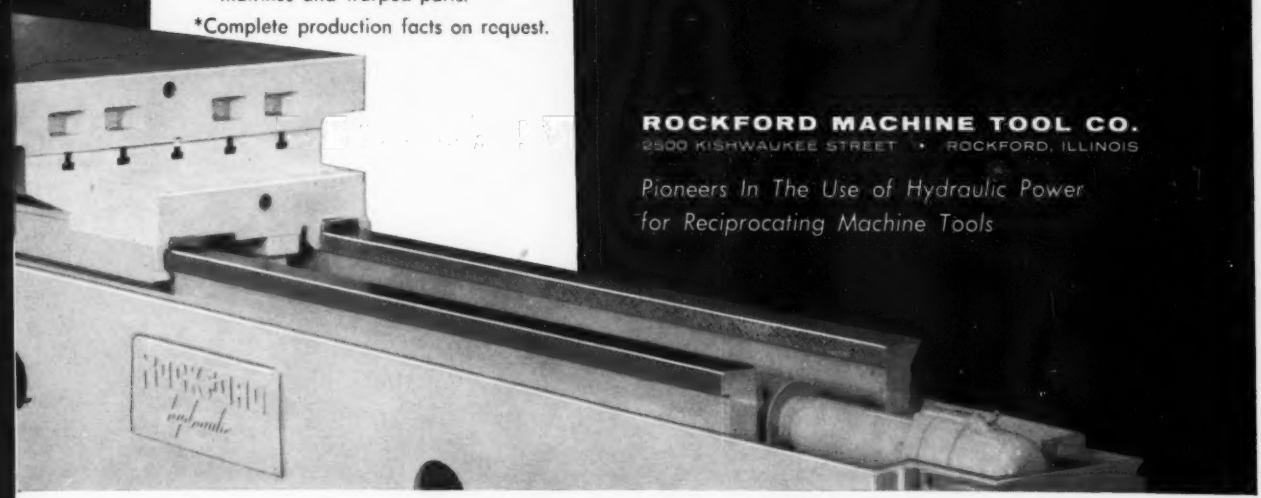
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- Produces parts from rolled billets instead of expensive forgings.
- Produces parts from inexpensive masters.
- Eliminates forging dies, machining matrixes and warped parts.

*Complete production facts on request.

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- Infinitely adjustable feeds and speeds;
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- Maximum metal removal per H.P. expended;
- Low Costs for machining, cutting tools and maintenance.



**ROCKFORD MACHINE TOOL CO.**

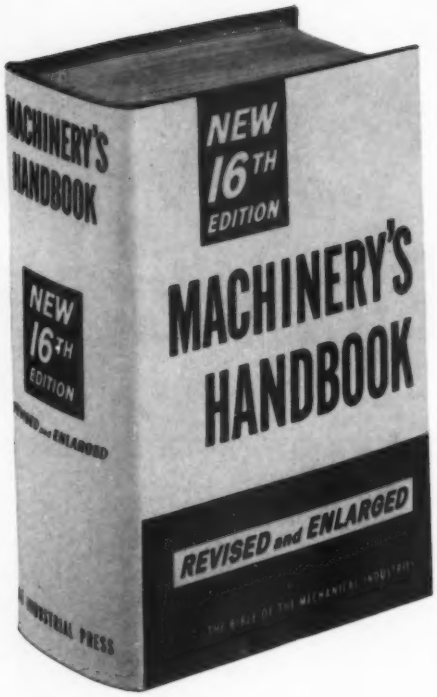
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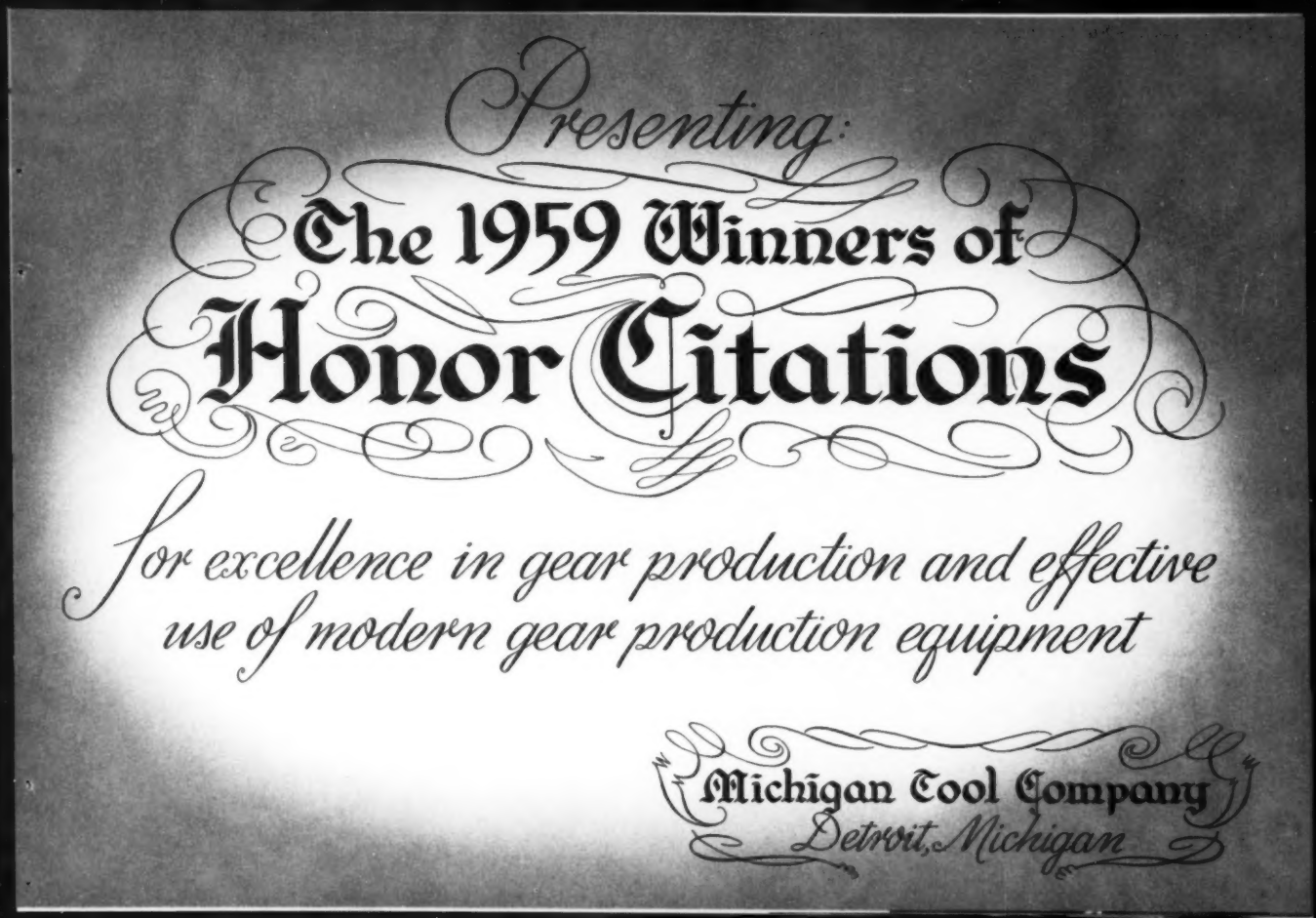
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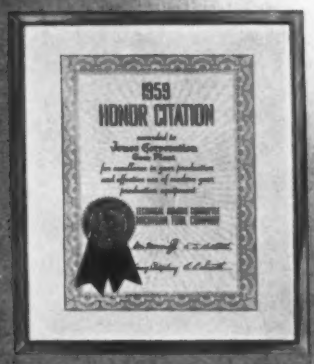
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Presenting:
The 1959 Winners of
Honor Citations
for excellence in gear production and effective
use of modern gear production equipment
Michigan Tool Company
Detroit, Michigan

# How the Citations were awarded...




About two years ago, Michigan Tool Company set up — as part of its own research and development activities — a committee of engineers familiar with both the techniques and economics of gear production. Prime purpose of this committee was to help guide Michigan Tool's own research and development on new methods and equipment through detailed studies of the techniques and operations at individual plants.

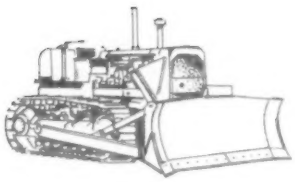
About a year ago, it was decided to give public recognition to those cooperating companies in industry, the study of whose operations revealed valuable progress in gear production methods and uses of modern gear production equipment.

During the past year the operations of a number of plants were studied and several of these were named by the committee as qualifying for Honor Citations.

The studies are continuing. Several additional plants have already been recommended by the committee for Citations in the coming year while still others may qualify as studies of their operations are completed.

The individuals to receive the Citations in behalf of the plants were nominated by the managements of the recipient companies.

## CATERPILLAR TRACTOR CO., Peoria Plant
## W. L. Naumann, Plant Manager

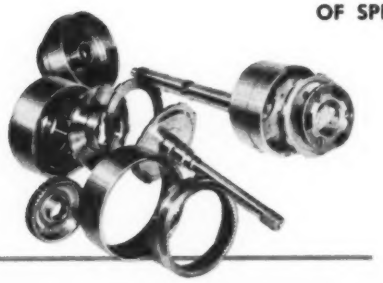


**OF SPECIAL NOTE:** Excellence in selection of tooling for production of heavy duty gearing to reduce costs and increase quality. Its extensive use of shaving to produce quiet gears of greater strength for road building and construction equipment was a factor in the selection of this plant for a citation.

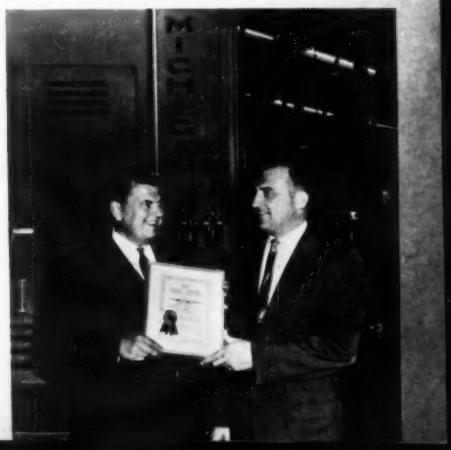


**Gordon Swardenski, Asst. Plant Mgr., left, receiving citation from M. R. Anderson, President, Michigan Tool Co. The machine in the background is an 873 finisher for heavy duty gears.**

## CHRYSLER CORPORATION, Kokomo, Ind. Plant
## James Cypher, Plant Manager



**OF SPECIAL NOTE:** The unique adaptation of the Shear-Speed gear-cutting process to the cutting of many types of tooth forms in a variety of materials — aluminum, steel, and cast iron.

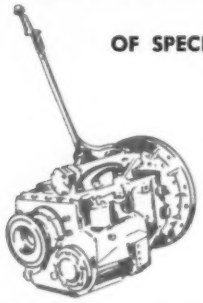


**James Cypher (right) receiving the 1959 Honor Award from M. R. Anderson, President of Michigan Tool Co. in front of one of the Shear-Speed gear cutting machines.**



John H. Jones receiving the Honor Award from H. Pelphrey, Research Director, Michigan Tool Co.

## DANA CORPORATION, Toledo Division
## John H. Jones, Works Manager



**OF SPECIAL NOTE:** Its constant search for quality as evidenced by the quick adoption of abrasive gear finishing to improve the accuracy of hardened gears for heavy duty transmissions and eliminate any possible burrs and nicks resulting from handling of gears in process.




Michigan Abrasive Gear Finisher used to improve accuracy of hardened gears by Dana Corp.

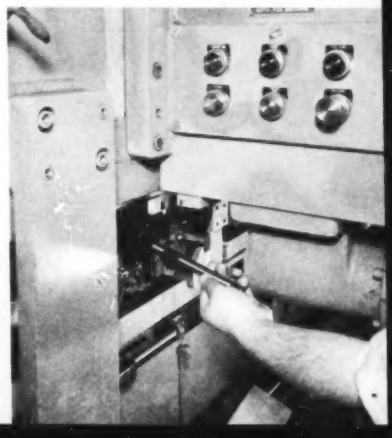


C. E. Kopp (right) receiving the 1959 award in the motor boat engine field from Michigan Tool's president M. R. Anderson.

## EVINRUDE MOTORS, Milwaukee
## C. E. Kopp, Factory Manager



**OF SPECIAL NOTE:** Evinrude's vision in adapting chipless machining to the production of motor boat engines, particularly on stainless steel shafts — increasing strength of shafts and eliminating wastage of materials in the form of chips.



Rolling of involute teeth on Evinrude's stainless steel shafts on a Michigan Roto-Flo machine.

## FORD MOTOR COMPANY, Transmission Division
## R. L. McNulty, Plant Manager, Livonia

**OF SPECIAL NOTE:** The manner in which this plant has reduced the hazard of human errors in gear production through selection of high precision production equipment and mechanization of handling of gears in process as through the use of Gear-O-Mation in-process storage, feeding, unloading, orienting, and allied equipment.

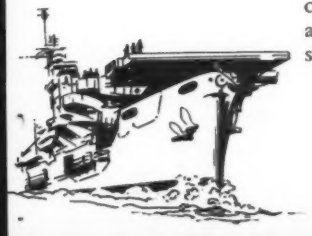


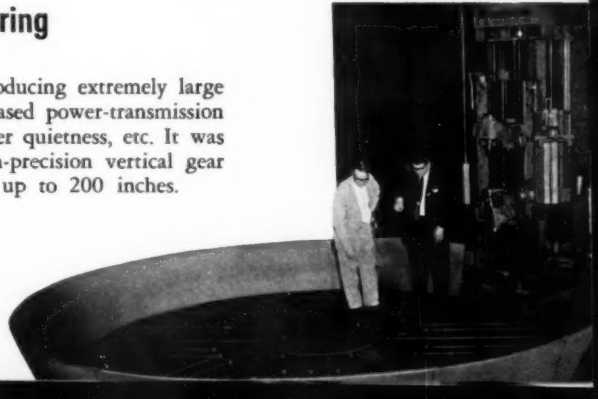


**Looking over some of the Gear-O-Mation equipment at Ford-Livonia are A. F. LeFevre, Quality Control Mgr; R. L. McNulty, Plant Manager; Stanley Cenzer, Mgr. of Mfg. Engrg; M. R. Anderson (President of Michigan Tool Co.) and E. M. Sirhal, Prod. Mgr.**

## GENERAL ELECTRIC COMPANY, River Works
## Jasper E. Anderson, Manager of Manufacturing

**OF SPECIAL NOTE:** The outstanding job done in producing extremely large gearing for ship propulsion resulting in increased power-transmission capacity for a gear of a given size, far greater quietness, etc. It was also a pioneer in the use of very large high-precision vertical gear shavers (Michigan V-series) to finish gears up to 200 inches.





**J. E. Anderson of G.E. and M. R. Anderson, President, Michigan Tool Co., standing on the table of one of G.E.'s huge Michigan V-series gear finishers—capable of producing highly accurate gears of up to 200" diameter.**

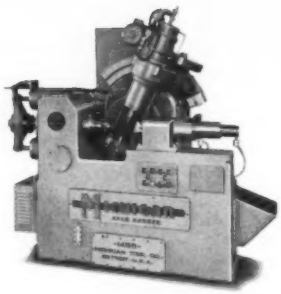


## INTERNATIONAL HARVESTER, Farmall Works
## Paul Bohy, General Supt. Division 2
## Ernest Palmer, General Foreman, Gear Lab.



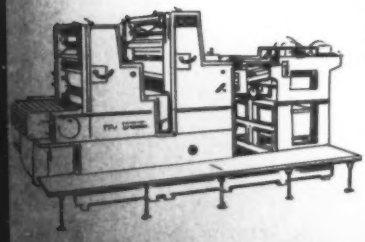
**OF SPECIAL NOTE:** Awarded the Citation in the tractor field, for the evidences of its constant search for equipment and methods which would reduce costs despite close tolerances. Example: Adaptation of high speed hobbing to the production of tractor gears.

**(Left) Walter Rodger, Asst. Supt. and (right) Ernest Palmer, with A. D. F. Moncrieff, Michigan Tool VP who presented the awards.**



**A battery of Michigan 1458A high speed hobbers like this is used at the Farmall Works.**

## MILLER PRINTING MACHINERY COMPANY
## Earl H. Sieg, Plant Manager



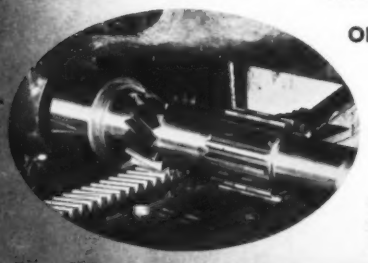
**OF SPECIAL NOTE:** The unusually tight tolerances which this manufacturer of offset printing machinery maintains on gears for offset printing equipment. Its constant checking for accuracy with the latest type of equipment.

**Miller Printing Machinery officials looking over recordings of 100% involute checking of gears (on a Michigan Sine-Line 1124) (l. to r.) A. A. Saul, Chairman of the Board; R. S. Hildreth (Chief Engineer of Michigan Tool Co.); Earl Sieg, Plant Manager, and W. G. Young, President. Miller also uses a Michigan 1218A optical checker for gear leads.**





## ROCKWELL-STANDARD CORPORATION
## Transmission and Axle Division, Newark, Ohio
## Wm. E. St. Clair, General Manager



**OF SPECIAL NOTE:** Its continued search for gear production equipment which will result in higher quality gears at lower cost for its double reduction axles. Its use of "870" type gear shavers for a variety of gear sizes and types is an example.

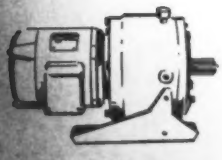
**"Undercut" shaving at Rockwell-Standard on the Michigan 900 helps keep gears in mesh.**



**(R to L) H. E. Kraning, Asst. Gen. Mgr. and Wm. E. St. Clair, Gen. Mgr. of Rockwell-Standard with H. Pelphrey, Research Director of Michigan Tool Co. looking over an unusual shaving job on a Michigan 900.**

## WESTINGHOUSE ELECTRIC CORPORATION, Nuttall Works
## F. D. Weatherholt, Division Manager, Gearing Div.

**OF SPECIAL NOTE:** This home of Moduline is believed to be the first to use chipless machining on gearmotor shafts, increasing uniformity, shaft strength and finish. Noteworthy are the close tolerances, extensive use of shaving, and precision checking to assure accurate gears both in job lots and in continuous runs.



**R. S. Hildreth, Chief Engineer, Michigan Tool Co., discussing "optical lead checking" on a Michigan 1218A with Mr. Weatherholt, R. H. Timmons, Mfg. Mgr., and R. L. Mathias, Engrg. Manager, of Westinghouse Gearing Division, where production gears of master gear quality are the rule.**



# Products and Services of "Gear Production Headquarters"

**LARGE EXPERIMENTAL LABORATORY** for development and pilot runs of gears and geared components as well as tooling for customers.

**GEAR CUTTING EQUIPMENT:** "Michigan" and "Michigan-Lorenz" hobbers; "Michigan-Lorenz" gear shapers; "Shear-Speed" Gear Shapers; hobs, shaper cutters, involute cutters, etc.

**GEAR FINISHING:** "Michigan" gear shaving machines; "Michigan" gear lappers; "Michigan" abrasive gear finishers (for hardened gears); gear finishing cutters and tools.

**GEAR CHECKING:** "Sine-Line" gear checking equipment for laboratory and production line checking and analysis of gears; "Sine-Line" hob checking equipment; "Ultradex" split-second accuracy index tables; master gears.

**AUTOMATION:** "Gear-O-Mation" standard and custom-engineered equipment for handling of parts in process (storage, loading, unloading, conveying, orienting, distribution, etc.).

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**CONSULTING SERVICE:** On all phases of gear design, tool design, processing, equipment, automation and economics of gear production.

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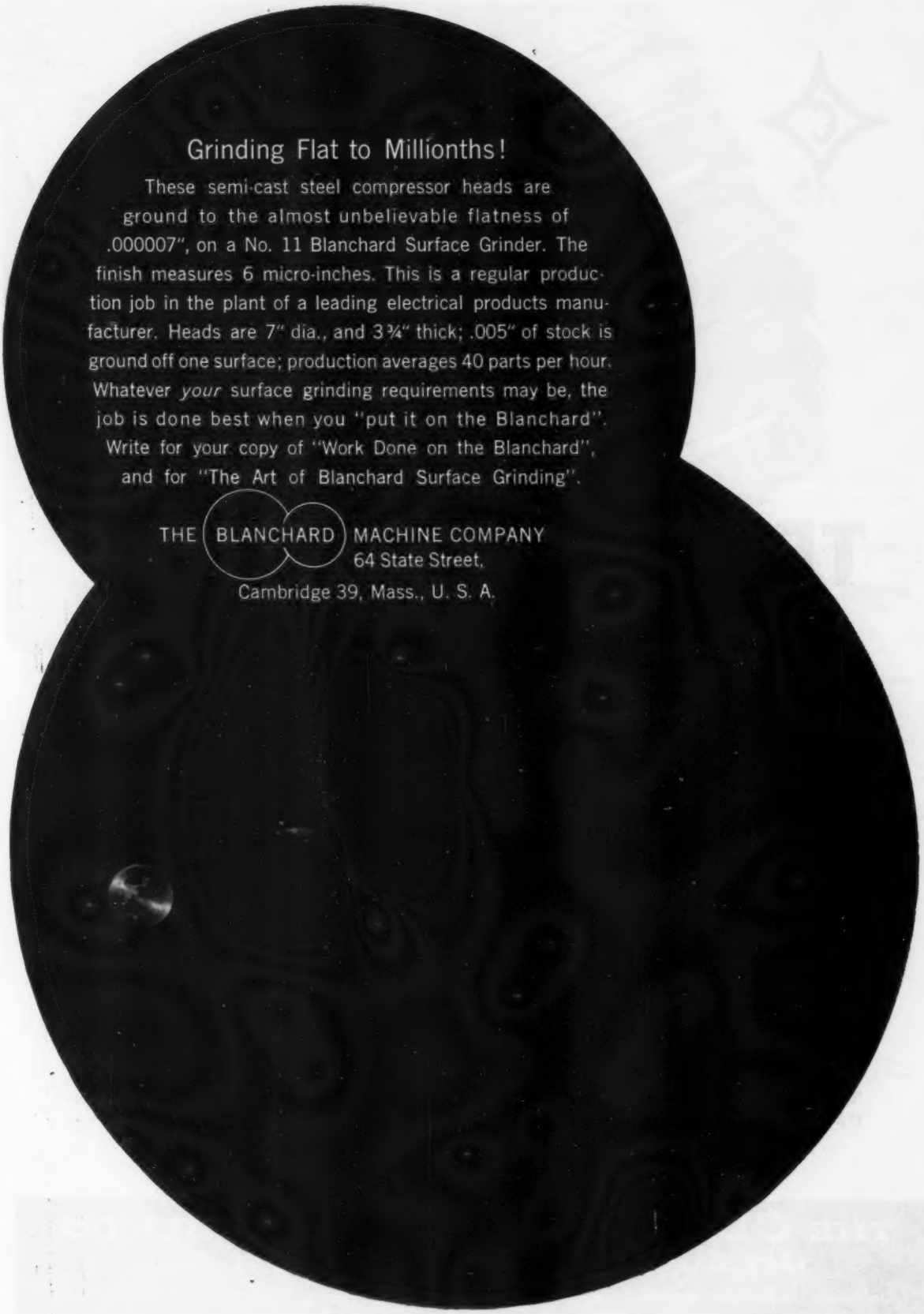
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# TEST after TEST

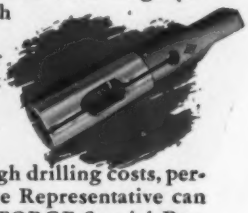
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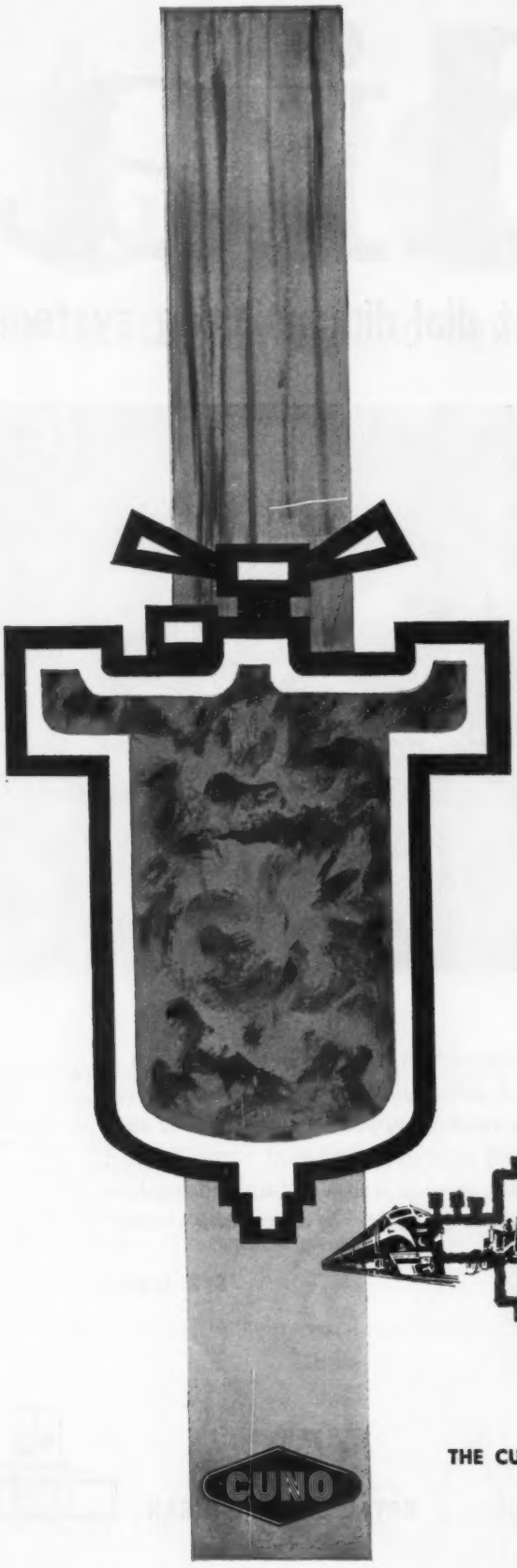
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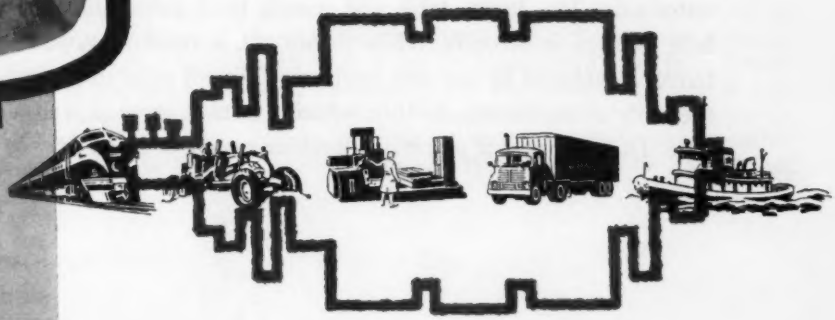



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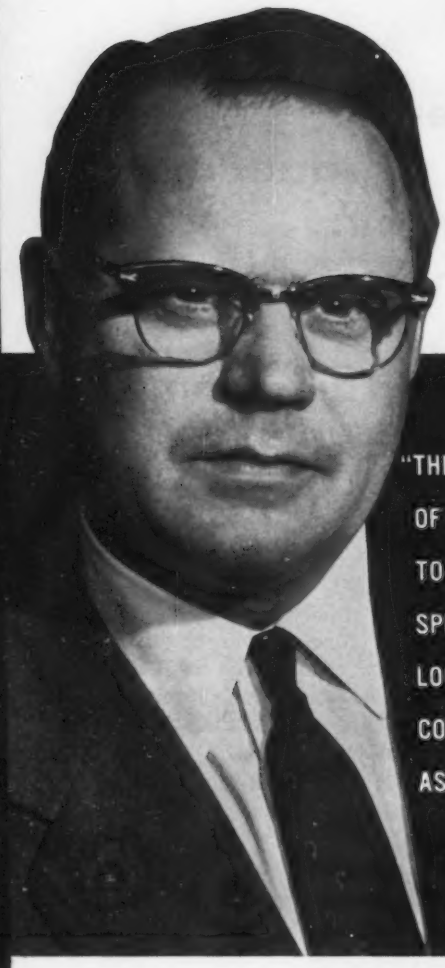


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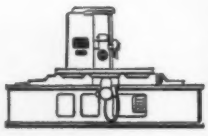


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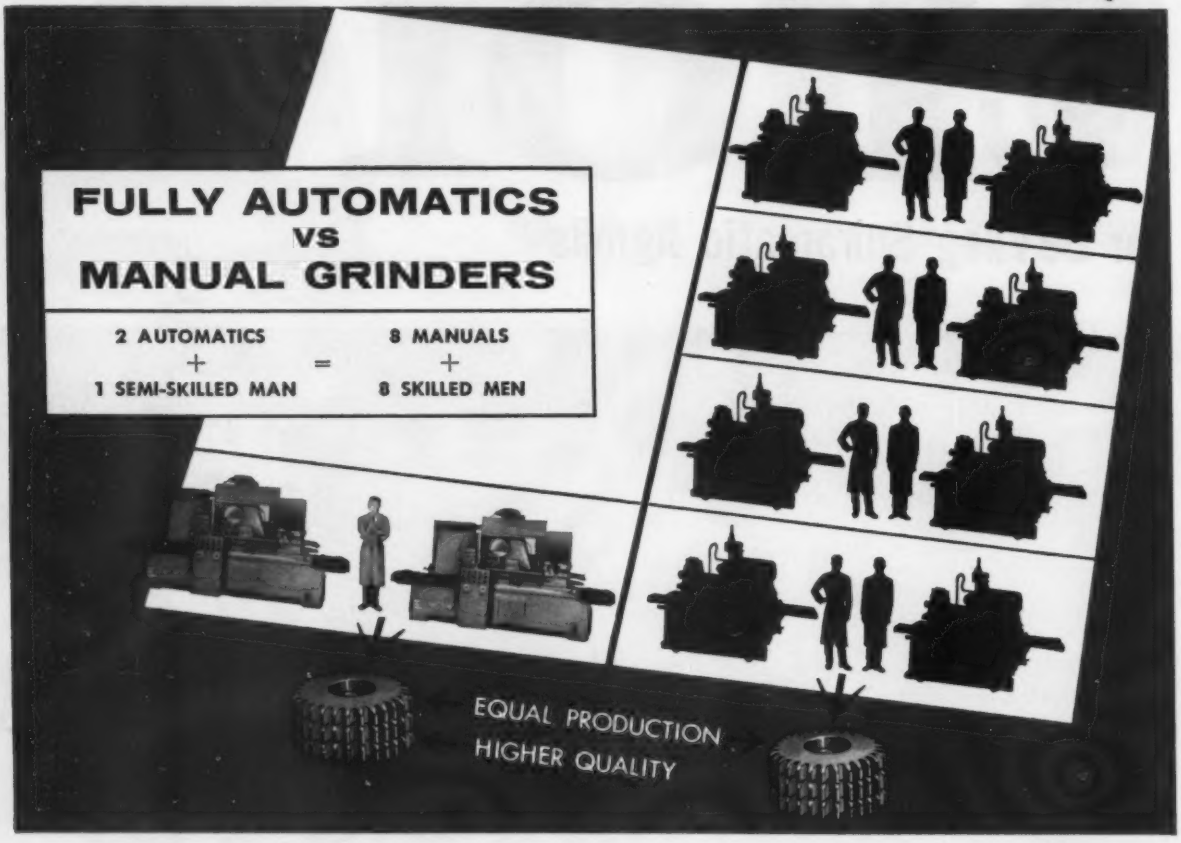
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Choose from any of these cycles with selective feed increments:

1 Rough grinding
2 Rough grind; finish grind
3 Rough grind; semi-finish grind; finish grind
4 Manual grind



**GEAR DATA**

| | |
|---|---|
| No. Teeth | 96 |
| Pitch Diameter | 26.7" |
| Diametral Pitch | 3.6 |
| Pressure Angle | 25° |
| Face Width | 4.5" |

**FLOOR TO FLOOR PRODUCTION TIME**

| | |
|---|---|
| Single Gear/Arbor | 55 min/gear |
| Two Gears/Arbor | 33 min/gear |

**GEAR ACCURACY**

| | |
|---|---|
| Involute Profile | Within .0002" |
| Tooth to Tooth Spacing | .0003" max. |
| Runout of Pitch Diameter | .0006" total |
| Lead Error | Less than .0001"/" |

GEARGRIND *Detroit*



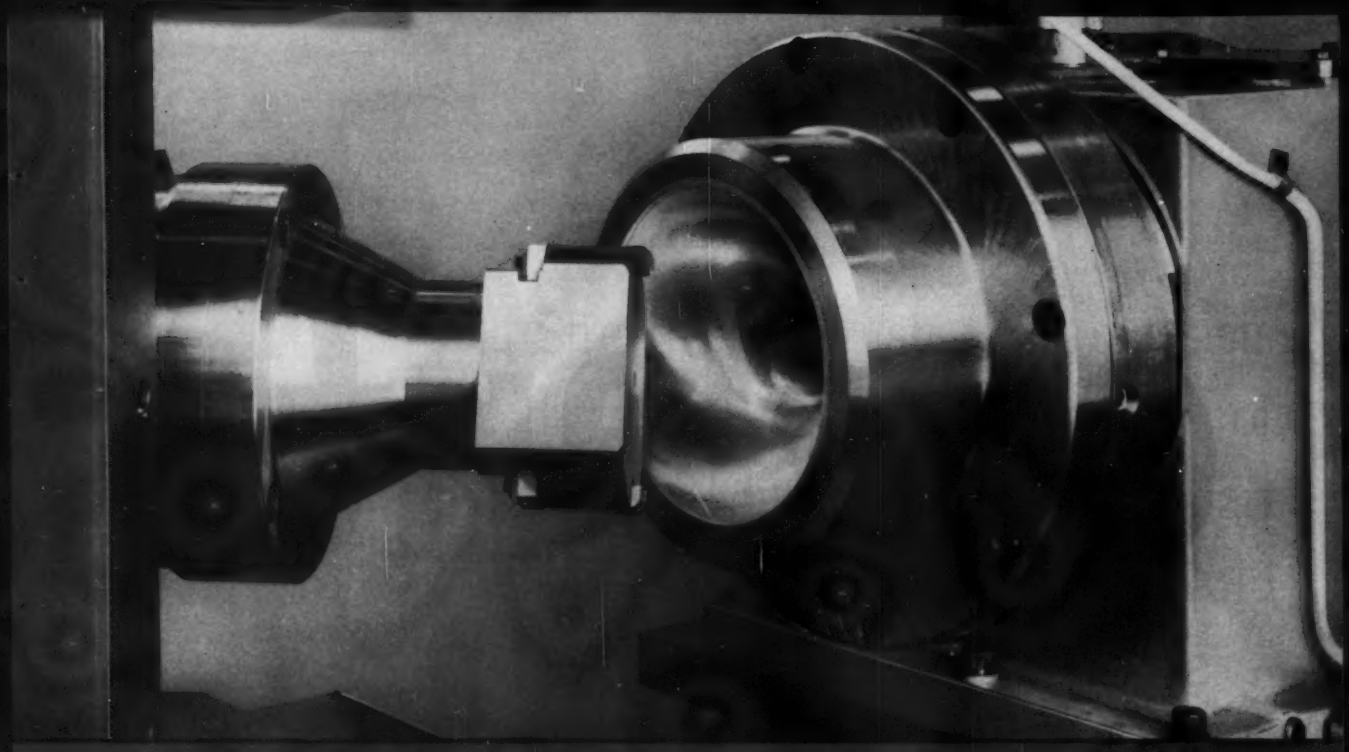
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58-MT5A



# EX-CELL-O CUSTOM TURNING MACHINE MEETS DEMAND WITH PERFORMANCE

**WORK:** Rough and finish turning of I.D. and O.D. with automatic cycling between loads.

**ACCURACY:** Less than .0001" tolerance on radii and .0001" on total wall thickness. Surface finish to 10 rms.

**MATERIAL:** Wrought or forged annealed aluminum hemispheres, 6" to 16" dia.



Custom-equipped with gages, spindle tachometers and other features, hemisphere-turning machine is a job-tailored "special"—yet it is designed to accommodate future production changeover.

59-34

Here are just a few of the reasons why this special Ex-Cell-O Turning Machine meets demand with *precision performance*—every time:

An extremely accurate and rigid work spindle helps slim-down the hemispheres shown at a rate of 15 cu. in. per minute with a 1/8" cut. Separate variable-speed hydraulic motors give cutter speeds from 50 rpm to 2500 rpm, and work spindle speeds from 1/18 rpm to 4 rpm. Dial gages provide constant checks on work spindle slide and cutter plunge depth. Vacuum chucks hold the work securely, and full electrical interlocking protects operator and machine during production.

Perhaps a similar Ex-Cell-O special machine—designed to handle future work as well—is the answer to a production problem in your operation. Call your Ex-Cell-O Representative, or write direct for full details.

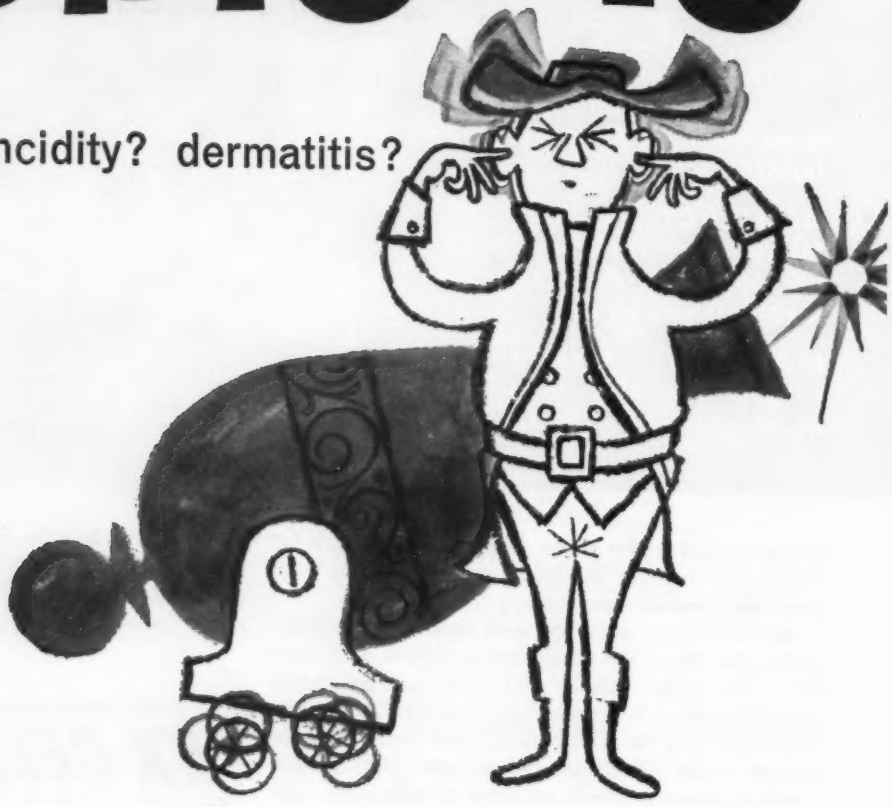
*PRECISION FOR EX-CELL-O* XLO

**EX-CELL-O CORPORATION**
DETROIT 32, MICHIGAN
*Machinery Division*

EX-CELL-O PRECISION PRODUCTS INCLUDE: MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • THREAD AND GROOVE GAGES • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

# coolant problems

rust? rancidity? dermatitis?





Cold Stream stops rust resists rancidity reduces causes of dermatitis These problems start when your coolant gets dirty. Cold Stream stays clean week after week—even on cast iron. Cold Stream gives longest tool life. Finest finishes. Highest speeds and feeds. Best dimensional control. Cold Stream gives you everything you ever expected in a coolant!

JOHNSON'S

# cold stream

Stays clean week after week and gives you all the performance you pay for.

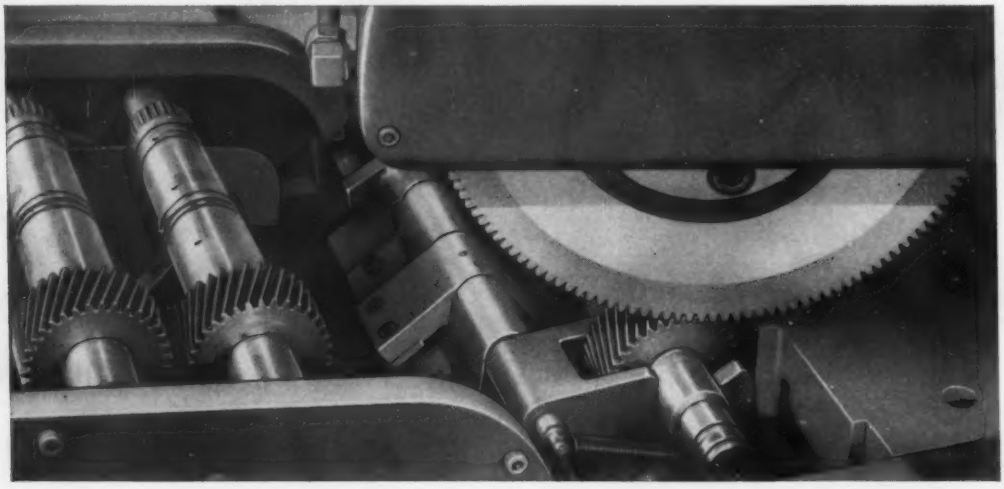
JOHNSON'S WAX

**For information, see your local Johnson industrial distributor.**

"Cold Stream" and "Johnson's" are trademarks of S. C. Johnson & Son, Inc., Racine, Wisconsin

Hard Gear Tooth Honing has completed the transition from an engineering research project to its present operational status in less time than any other major development in the field of modern gear practice. Why? Because Hard Gear Honing satisfies a long recognized need more economically than any other known process.

# RED RING HARD GEAR HONING Has Won Wide Acceptance



## USERS

- The aircraft industry
- The automotive industry
- Computing machine manufacturers
- Motorcycle industry
- Tractor industry
- Gear manufacturers
- Electric motor (gear head) industry
- Machine tool builders

## GEARS BEING HONED

- Transmission gears
- Timing gears
- Change gears
- Computor gears
- Main drive gears
- Motorcycle gears

## PURPOSE OF HONING

- To remove nicks and burrs
- To improve surface finish
- To improve noisy gears
- To salvage rejects
- To quickly detect errors in prior machining
- To correct minor heat treat distortions

*For complete details on Hard Gear Honing, write for Bulletin H-57-2.*

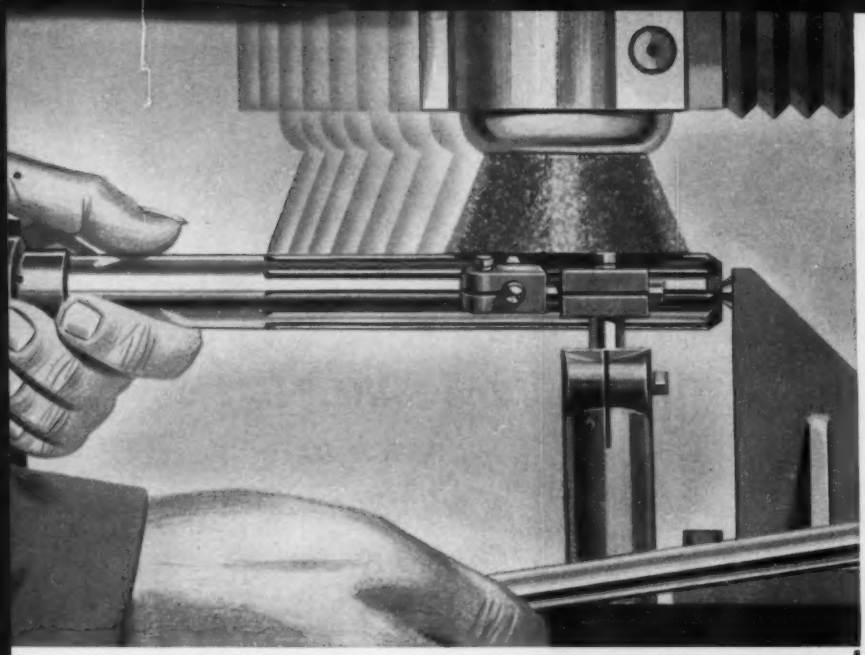
SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING, GEAR HONING AND ELLIPTOID

8269

**NATIONAL BROACH & MACHINE CO.**

5600 ST. JEAN • DETROIT 13, MICHIGAN

*WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT*



# OLIVER "ACE" TOOL AND CUTTER GRINDER

## Traverses the wheel—not the work!

You can grind tools and cutters more accurately with the Oliver "ACE" because the wheel is brought to the work, reversing the usual process. Abrasive dirt and grit cannot cause wear because the cross carriage is not in motion. The horizontal ram which supports the grinding head is fully enclosed—sealed against dust and dirt. Further accuracy is assured because the wheel is trued by a stationary diamond which provides a fixed grinding line. It is not necessary to reset the cutter to compensate for wheel wear.

The "ACE" is a tool and cutter grinder designed expressly for tool grinding—not a general purpose machine adapted to tool room work. It is simple to set up. All angles are obtained by direct reading. Operators stand in a natural position with the control lever in easy reach and the work in direct view.

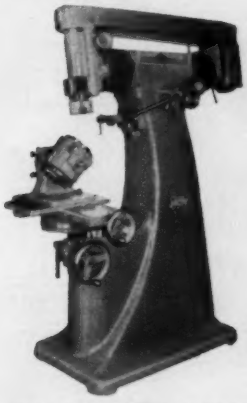


Face mills, reamers, end mills, staggered tooth cutters, slab mills, spot facers—all cutters straight or spiral—are quickly, easily and economically sharpened with the Oliver "ACE". Both standard and heavy duty models are extensively used for sharpening carbide-tipped circular wood saws used in both woodworking and metalworking.

Write today for complete information. We'd appreciate the opportunity of sending a quotation.

## HOW TO REDUCE YOUR CUTTING TOOL COSTS

Three elements are absolutely necessary if there is to be a substantial reduction in cutting tool costs—the right tool, the right geometry of grind on that tool, and the right machine to produce the grind. There are various machines which will always be most suitable for specific applications. However, for the average cutter grinder jobs, Oliver has pioneered a new approach to the problem with the introduction of the "ACE" tool and cutter grinder.



*The Heavy Duty "ACE"*

The cost savings are attractive with respect to both setup time and grinding time. Setup usually consists of two simple "direct-reading" adjustments. The first setting is made to produce the angular or straight line grind requirement. The second setting consists of tilting the grinding wheel spindle to produce the proper clearance—all extremely simple.

Grinding time is reduced considerably because tool travel is eliminated in most cases. Thus the time consists wholly of bringing the grinding wheel on and off the cutting tool. This compares extremely favorably with competitive grinding procedures.

This combination of easy setup and rapid grinding is found only on the economically priced Oliver "ACE" tool and cutter grinder.

There are two versions of the "ACE": the standard, which is suitable for high speed and light duty carbide grinding, and the heavy duty model which is designed for grinding tungsten carbide cutters and tools in all of their many forms.

# OLIVER of ADRIAN

1410 E. Maumee St. • Adrian, Michigan

DRILL GRINDERS AND THINNERS—TOOL AND CUTTER GRINDERS—AUTOMATIC AND MANUAL FACE MILL GRINDERS—TOOL BIT GRINDERS—CONTOUR SAWING AND FILING MACHINES




*The BAKER BASIC approach to production flexibility and retooling economy*

**BAKER®**

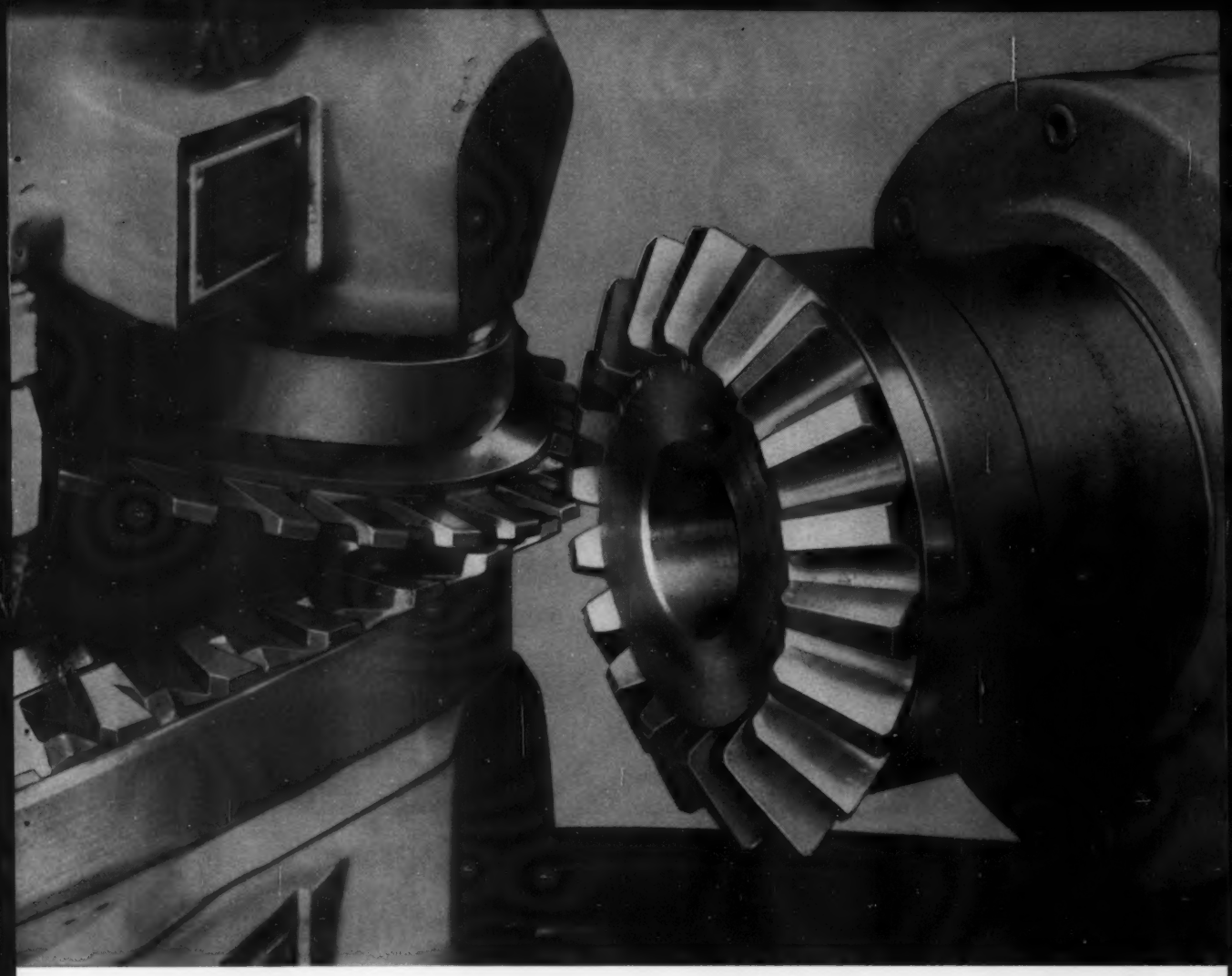
*interchangeable heads . . . and tables*

*BAKER BASIC STANDARD VERTICAL MACHINES AVAILABLE IN 12", 18", 24" WAY WIDTHS*

*The same selection of fixed and adjustable spindle heads can also be used interchangeably with BAKER HORIZONTAL models in 12", 18" and 24" way widths. For the complete, illustrated story of BAKER VERTICAL AND HORIZONTAL HYDRAULIC DRILLING AND TAPPING MACHINES, write for new free catalogs. BAKER BROTHERS, INC., DEPT. MH-1059, TOLEDO 10, OHIO.

**BAKER®**

STANDARD HYDRAULIC MACHINES • AUTOMATIC BAR MACHINES • SPECIAL MACHINE TOOLS • COMPRESSION MOLDING MACHINES



# How to complete gears up to 16" O.D. in one cut from the solid

The Gleason No. 114 Straight Bevel Coniflex® Generator cuts gears directly from the solid in diameters up to 16", up to 2½" face width and 2½ diametral pitch.

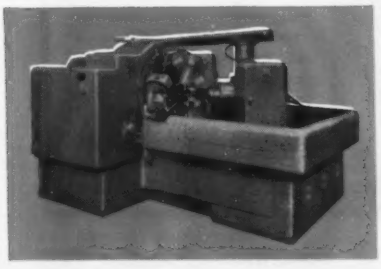
With it you obtain much faster production rates—up to five times faster than with other methods. Still it retains a basic flexibility which permits quick changeovers from one job to another.

**Excellent quality.** Even with the speed of the No. 114 Coniflex Generator, quality remains excellent. It provides a smooth blend of root, fillet, and tooth flank—your assurance of strong, accurate teeth.

Coniflex gears give localized tooth bearing, too, assuring practical assembly tolerances.

**Simplified calculations.** You can do all calculations with a slide rule. You can also control tooth bearing easily to suit various operating conditions or to set up interchangeability with existing gears.

For more details on the No. 114, write for bulletin.



77

**GLEASON WORKS**

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.



# Machinecraft gets .0005" tolerances with Cities Service Chillo Cutting oils!

Machinecraft, Inc., of Whitman, Massachusetts, makes a product that is surely the answer to many a textile man's fondest wish.

In place of old-style solid arbor top rolls, which often drip lubricant onto the fabric, Machinecraft has developed "the anti-friction top roll."

Operating on ball bearings, this unique invention requires almost no lubrication, therefore eliminates staining problems. In addition, it permits higher speeds of operation and produces more uniformly woven fabric.

In all of this, extremely intricate machining is required —and Cities Service Chillo Cutting Oil plays a crucial role.

Using Cities Service Chillo "A," Machinecraft is actually achieving tolerances as fine as .0005"! Moreover, Machinecraft reports that Chillo "A" gives "excellent tool life, produces a fine finish, has unusual stability, and offers continuous quality from batch to batch."

**"In addition," continues this well known firm, "Cities Service provides us with exceptional technical assistance and good delivery service."**

There's little to add to what Machinecraft says except a reminder that *you* can expect similar results with Cities Service, too. Talk with a lubrication engineer from the nearest office. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

**CITIES SERVICE**

QUALITY PETROLEUM PRODUCTS



**Machinecraft's Anti-Friction Top Roll** is rapidly replacing old-style solid arbor type top rolls in textile mills. It prevents staining, permits greater operating speeds.



**Shadowgraph** is method of checking accuracy of precision machined parts for anti-friction top roll. Machine magnifies and projects the part's shadow outline. Tolerances are as fine as .0005".

# WHATEVER YOU WANT A PRESS TO DO...




# THERE'S A BLISS PRESS TO DO THE JOB BETTER!

## Bliss makes more types and sizes of presses than any other builder

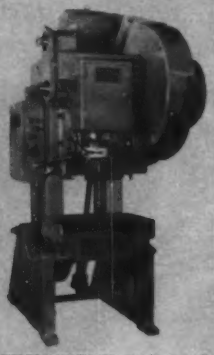
No matter how big or how complex that next metal stamping job may be, it makes sense to call on Bliss. Size never has presented any problem to us, and complexity is our specialty. And because Bliss makes more types and more sizes of presses than any other builder in the business, you're sure to get impartial counsel—sure that your trained Bliss representative will "grind no axe" for any one type of press. And remember this: he's backed by more than a century of experience in building presses of all types, all sizes, for all kinds of industry.

BLISS
SINCE 1857

*BLISS is more than a name it's a guarantee*

**E. W. BLISS COMPANY, Canton, Ohio**

PRESSES • ROLLING MILLS • ROLLS • DIE SETS
CONTAINER MACHINERY • CONTRACT MFG.



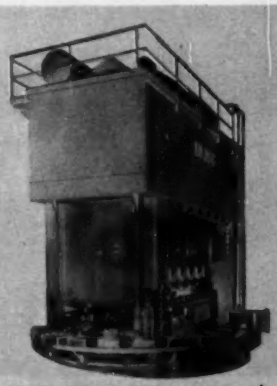
**INCLINABLE PRESSES** . . . in bench, single or double crank, modern enclosed design. With air friction or mechanical clutches, and whatever you need in cushions and feeds.



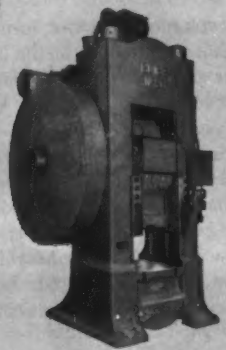
**STRAIGHT SIDE PRESSES** . . . eccentric and crankshaft models . . . any size . . . modern enclosed design, with whatever automatic features you want.



**HIGH PRODUCTION PRESSES** . . . specially designed for continuous high speed automatic operation. Up to 1000 spm. Available in a variety of sizes . . . and precision feeds.



**TRANSFER FEED PRESSES** . . . for the ultimate in production. Bliss pioneered the development, now builds them for blank or coil stock work, with no limit on size.



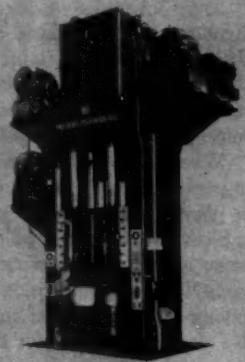
**KNUCKLE JOINT PRESSES** . . . for slow, powerful application of pressure at near-bottom stroke. Bliss builds them from 75 to 10,000 tons capacity in 40 standard models for coining, embossing, extruding, sizing and swaging.



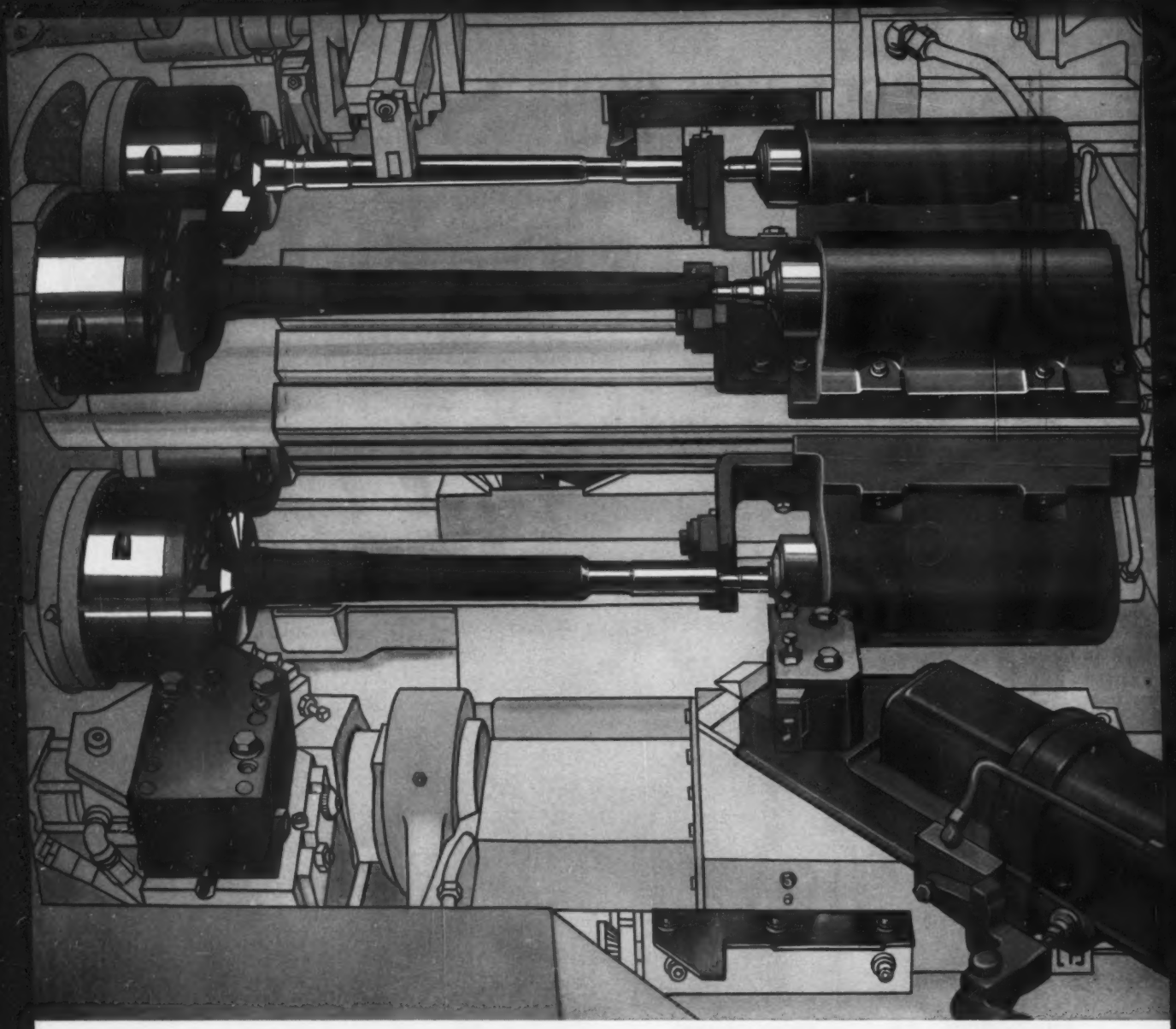

**FORGING PRESSES** . . . for production of turbine blades, crankshafts —hot forging, cold coining and other operations. Built in a number of sizes, from 300 to 4000 tons capacity, to standard and special design.




**TOGGLE PRESSES** . . . Double and triple action designs with quick advance and return speed features; modern electronic controls and automatic lubricating systems. From giant "automotive" sizes to compact units for small parts.



**HYDRO-DYNAMIC® PRESSES** . . . single action or double open rod construction or closed, 20 tons capacity to 35,000 or even more, standard design or special high speed models, electronic controls —Bliss has built them all.



# **idea** *for volume producers of shafts*

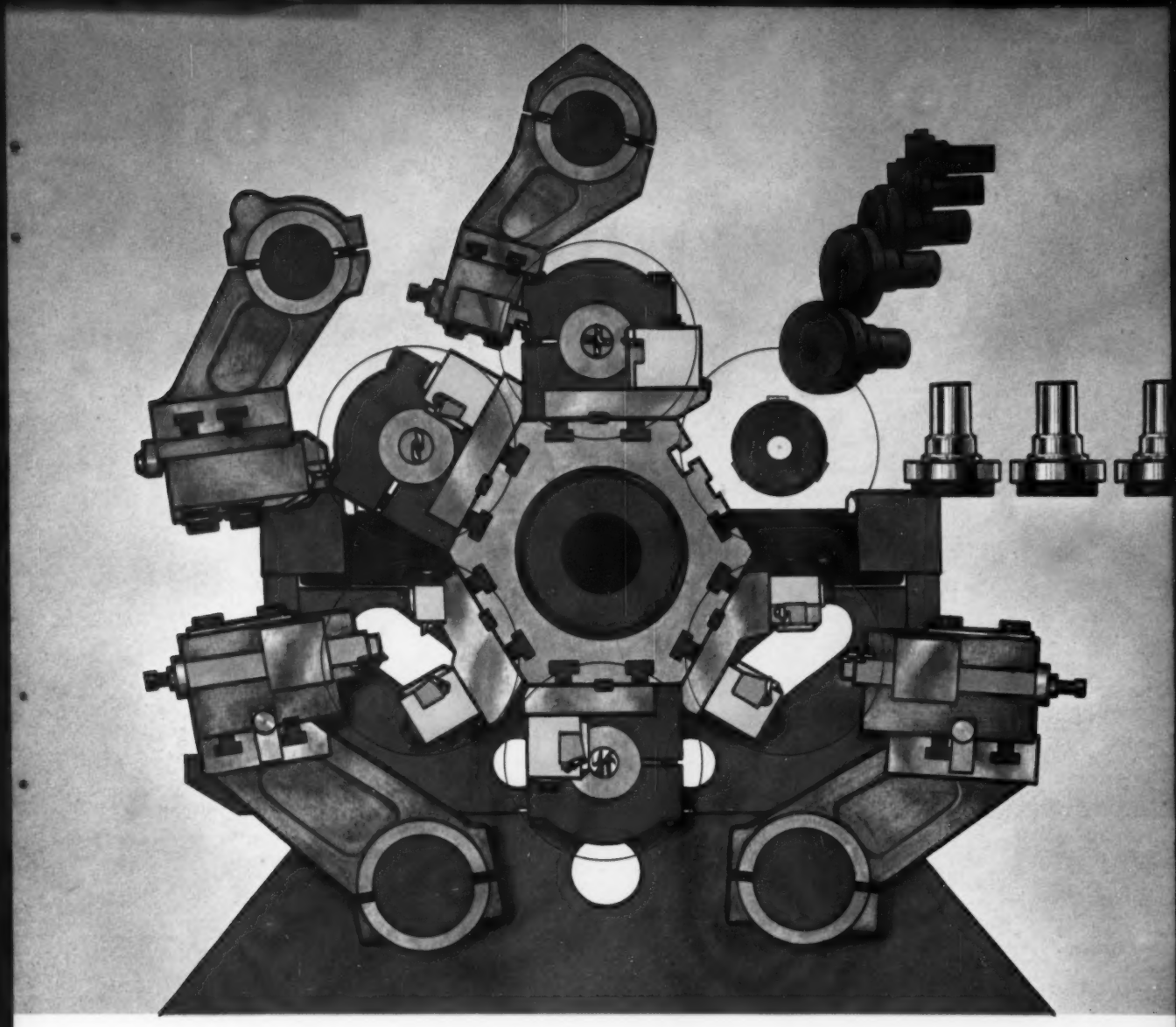
Economists are making startling predictions on this year's increase in productivity. They say it will be twice that of recent years – up as high as 10% in some manufacturing industries.

Whether or not these predictions come to pass, it's certain that it won't happen in plants using outdated equipment.

Shaft work is a problem to many firms. New Britain pioneered template-controlled contour turning and boring, solving the problem for many progressive companies. Now for the manufacturer with really high volume requirements we present Model 412/25—a four-spindle, template-controlled machine capable of producing a four-fold increase in productivity per man hour.

The basic principle pretty much speaks for itself. As in the case of the single-spindle contour lathe, inexpensive metal templates control the full cycle and re-cycle if required. Simple, single-point tools replace complex gang tooling. Set-up is simple and fast. When tools wear, merely replace them. Since all relationships are maintained by the template, tool replacement involves no problem.

When the volume of contour turning warrants it, this machine can be the best money maker on the production floor. Your New Britain representative can quickly tell you after looking at your prints and learning of your production requirements. Meanwhile, we would be glad to mail you descriptive literature containing the basic facts and specifications. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.



# **two** *approaches to the depreciation problem*

Until there is relief in the form of a more liberal tax depreciation policy, there's only one way to avoid the pinch of a shop full of over-age machines you can't afford to replace: *Buy machines that will stay new.*

If you are a user of New Britain chuckers you have seen their basic principles continue to stand as the most advanced design available, year in and year out.

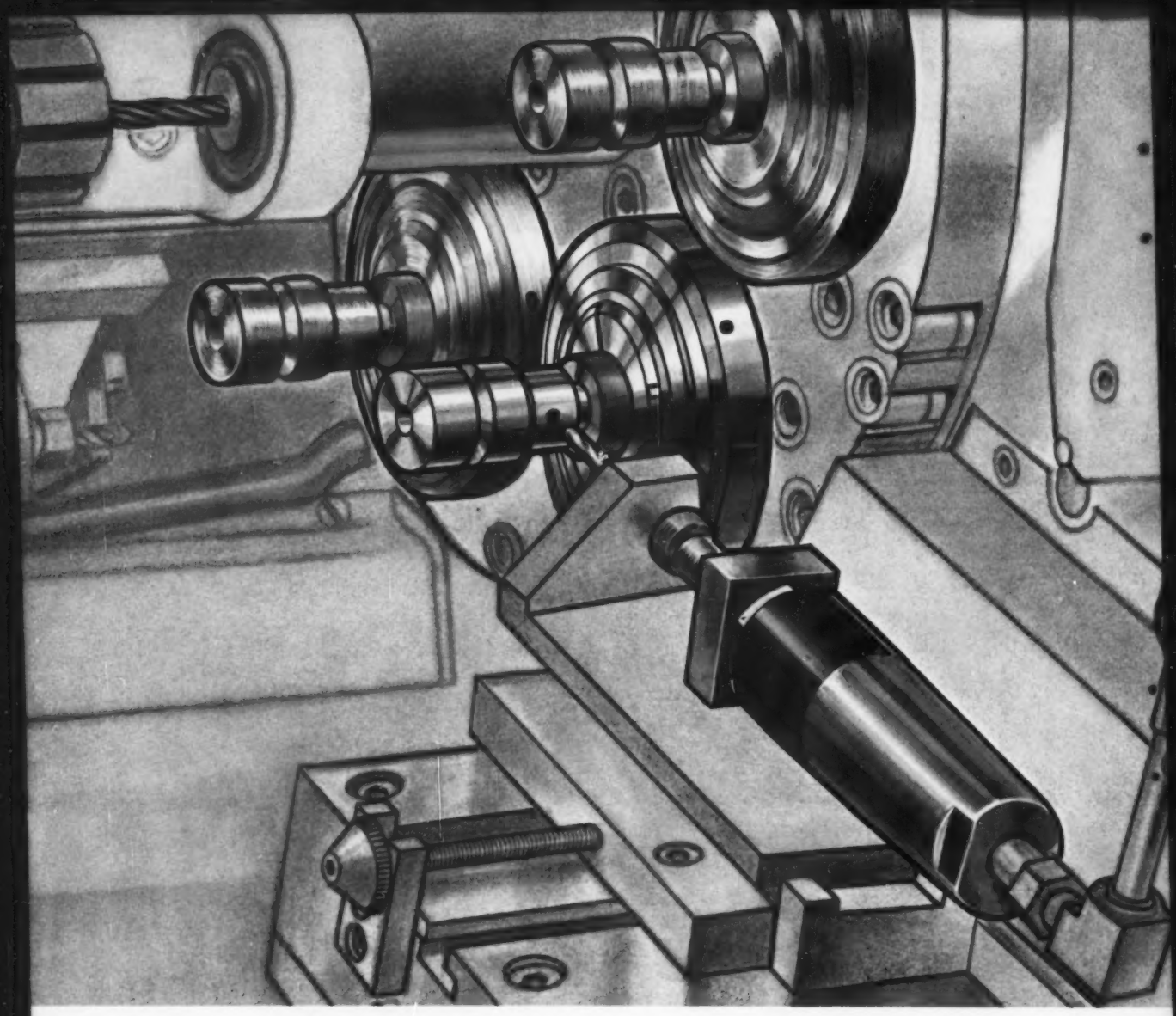
What value do you place on lifetime machine accuracy? The spindle carrier is the heart of a chucking machine. On a New Britain the carrier is lifted during index so it can't wear—then positively clamped to the frame during the cutting cycle for accurate cutting.

Interested in heavy facing and forming cuts? The long established New Britain swinging forming arm feature remains the best answer.

Want maximum clearance for fast and easy tooling, adjustment, and chip removal? Only New Britains are built with open end construction.

Today's New Britain chuckers provide the spindle speeds and power to take advantage of the most modern cutting tools. Optional tooling equipment includes drill speeders and attachments for reversing and non-reversing threading, recessing and accelerated reaming.

A new catalog describes the full New Britain line of 4-, 6- and 8-spindle, open-end, chucking machines. Fully illustrated in color, showing actual jobs, it may well suggest ideas for doing your work. Write for your copy. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.



# *1960 productivity* **now**

If you have a voice in the purchase of machine tools you have probably begun to think in terms of what will be on exhibit at next year's Machine Tool Show.

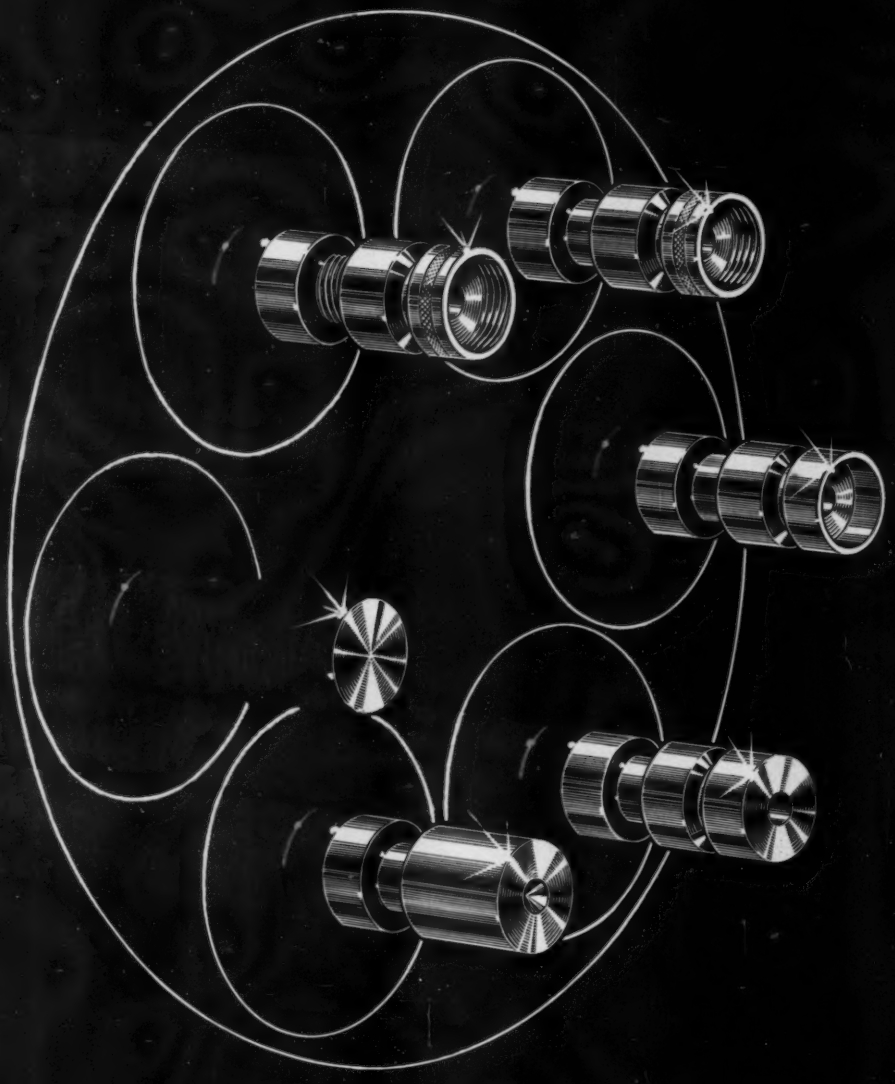
As far as multiple spindle bar work is concerned, you can see and buy and profit from the "show year" developments of New Britains a year ahead of time.

More operations, more pieces per hour, at closer tolerances has been the demand for years. Now New Britain has brought out a complete new line of bar machines that gives these words a brand new meaning.

Take the new Model 45 4-spindle series. The spindle capacity of 5" puts much larger pieces within automatic high-speed bar machine production range. Cross slides in all positions greatly increase the number and variety of cuts possible on four spindles. Spindle speeds up to 526 RPM provide for the use of the latest cutting tools. At the other extreme is a new line of 8-spindle machines. As you would expect with New Britain's radial independent cross slides, you can apply a tremendous number of tools and attachments to get very high production on really complex pieces. Or, with a double indexing set-up, you can turn out pieces, even pretty complex ones, at an all-time high rate per hour.

Six-spindle machines are everybody's work horses and New Britain offers the Model 52 in the 1¼" range, and the Model 62 with 2¼" capacity. These machines allow you to use a greater number and variety of tools on them without sacrificing accessibility. They can be tooled quickly and you can get at the tools for changes or adjustments with ease.

We can only suggest here some of the "show year improvements" in a greatly expanded line of New Britain bar machines. Your New Britain representative will be glad to arrange for a demonstration, and secure performance data based on your prints. If you would like to look over a catalog first, we'll be glad to send you complete descriptive literature. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Conn.



# 3½"—*More* **capacity** *than ever in a New Britain*

**Model 82 • Six Spindles • 3½" Capacity • All New**

Here is a *brand new* New Britain . . . the most modern large capacity bar machine available. The Model 82 brings to the 3½" size range all the versatility and exclusive New Britain features previously available only on smaller models. Designed from the ground up for large capacity work, the Model 82 is the only 6-spindle machine on the market that offers a really up-to-date replacement for the older, slower methods currently used for this size range.

Each of the six spindles on the Model 82 has an independent, cam-operated cross slide. These cross slides combined with the end-working tool slide allow practically unlimited tooling combinations.

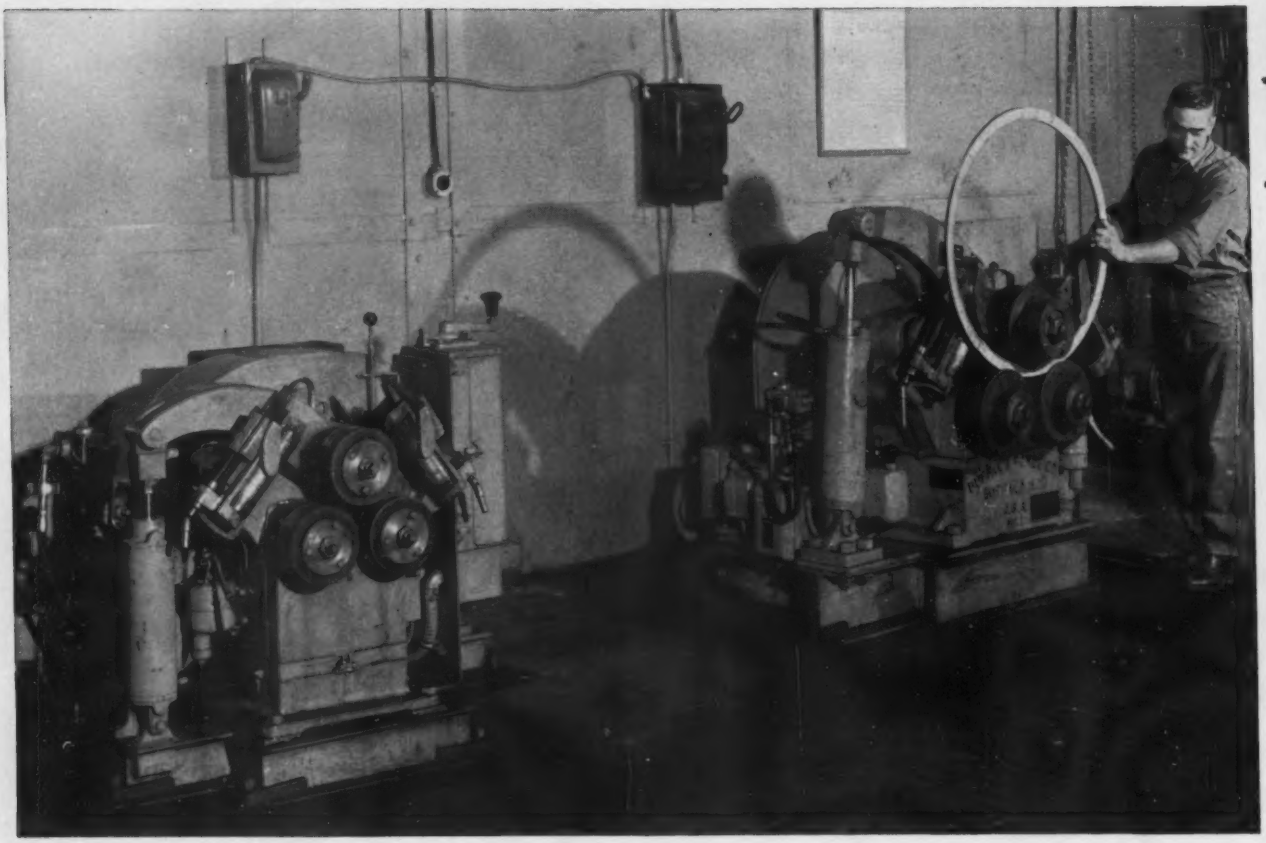
The Model 82, like all New Britain Bar Machines, has a special lifting and locating mechanism which prevents wear on the spindle carrier. Rigid locking of the carrier to the massive frame during the cutting cycle eliminates vibration.

The power, massiveness, speed range, accuracy, ease of changeover, coolant capacity and every other feature designed into the Model 82 makes this the right machine for high-precision, high-production, large-capacity bar work.

Why not investigate the possibilities the Model 82 offers in your plant? When you get right down to it, it's the first chance you've had in a long time to update production in an area that needs it badly. Complete catalog material is available on the whole range of New Britain Six Spindle Bar Machines. For your copy, write to The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Conn.



For more data, circle this page number on inquiry card



Three "Buffalo" Vertical Bending Rolls, Nos. 0, 1 & 2.

# LET "BUFFALO" TAKE THE KINKS OUT OF YOUR

**Wide Range of Sizes for Almost Every Application . . .**

Do you bend structurals into circles, segments or spirals? You could be boosting production and cutting costs right now—with a "Buffalo" Bending Roll. These versatile machines save real time and money bending angles, rounds, squares, tubes, beams, channels, flats and special shapes.

There's a size and model to fit your needs—exactly. Choose from horizontal or vertical types. Capacities range from ½″ x ½″ x ⅛″ angles bent to a 4″ circle, to 8″ x 8″ x 1″ angles in diameters from 84″ up.

No dies are needed. Rolls are quickly changed and easily adjusted to handle practically any structural shape and diameter. Special rolls and attachments are available for specialized operations including leg-in bending.

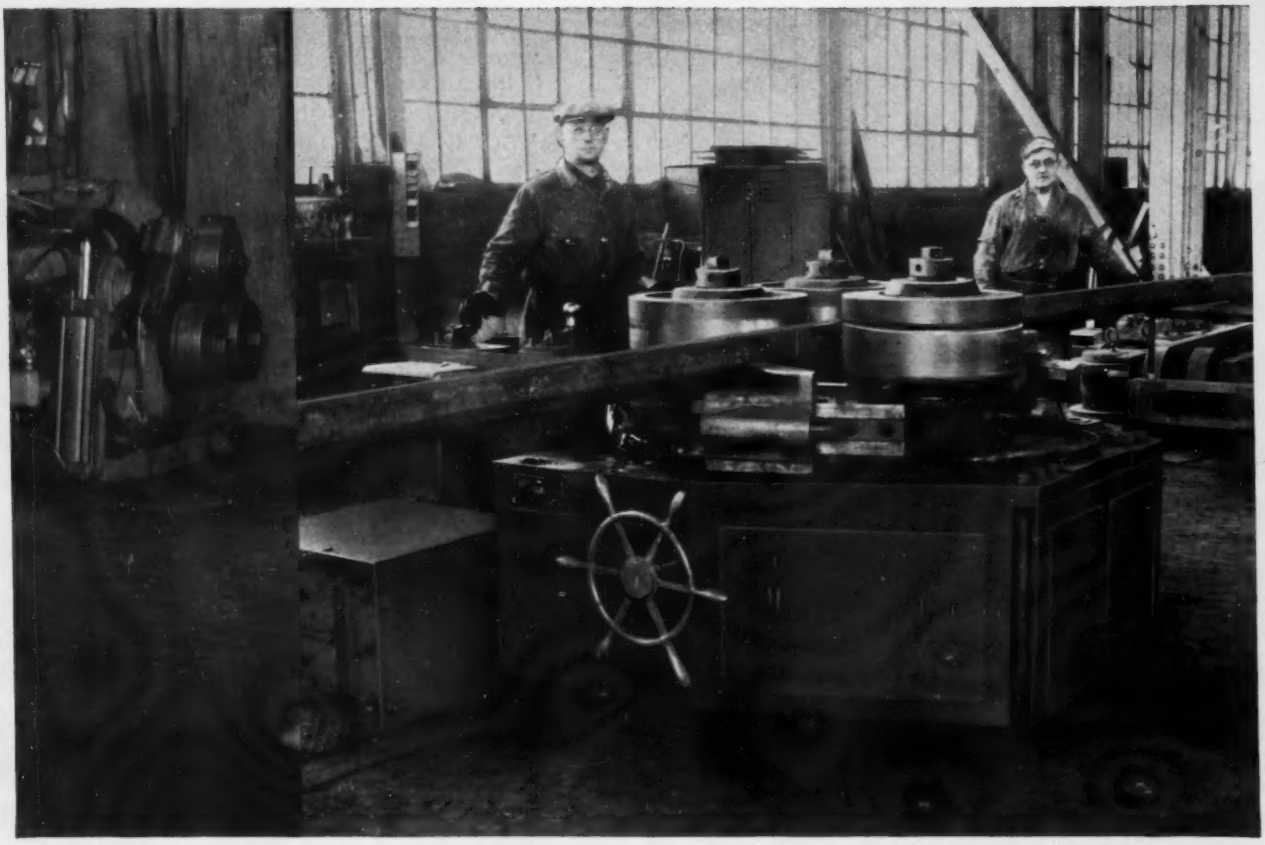
Unique "Buffalo" design offers many advantages. When furnished wth hydraulic adjustment on upper roll, finished circles can be removed instantly, cutting production time by 30%. Wasteful straight ends on circles are kept to a minimum.

Decide now to improve your production bending. Ask your nearby "Buffalo" machine tool dealer for complete facts on "Buffalo" Bending Rolls. Or write for Bulletin 352-D.

"Buffalo"

**BUFFALO FORGE COMPANY** 440 Broadway • Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.



"Buffalo" No. 3 Horizontal Bending Roll Handling Heavy Angles to be used in fabrication of Spherical Water Tank.

# PRODUCTION BENDING!




**Specially Designed to Speed Diversified Production!**

The "Buffalo" No. "OA" Bending Roll at right provides faster production on structural shapes requiring bending. This machine has proved especially useful in the aircraft and related industries. Complete retooling is accomplished in a few minutes. Special rolls and attachments permit an almost infinite range of uses. For full details on "Buffalo" No. "OA" Bending Rolls, write for Bulletin 3344-B.



DRILLING PUNCHING SHEARING BENDING

**NATIONAL ACME'S**
"ZONE OF RESPONSIBILITY"
**INCLUDES ALL PHASES OF COST REDUCTION**

*Check YOURS...Then Check National Acme*

**Direct Costs:** these include direct dollar savings as realized by Minneapolis Honeywell . . . an "every day" job for Acme-Gridleys.

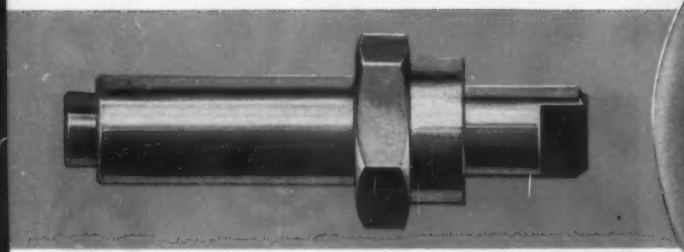
**Indirect Costs:** effecting important savings in maintenance, downtime, scrap reduction, tool costs, etc.

**Product Redesign:** teaming with your design group to take full advantage of Acme-Gridleys' cost reducing capabilities.

**Direct Material Costs:** our engineers provide important savings in this area by constantly matching machines and tools to modern metallurgical problems.

**Make-or-Buy Reviews:** in many cases our Contract Division can assume your production headaches and relieve you of immediate capital investment.

**Spot Modernization:** pioneering in modern tooling methods, and the flexibility of Acme-Gridleys can provide many "on-the-spot" savings.

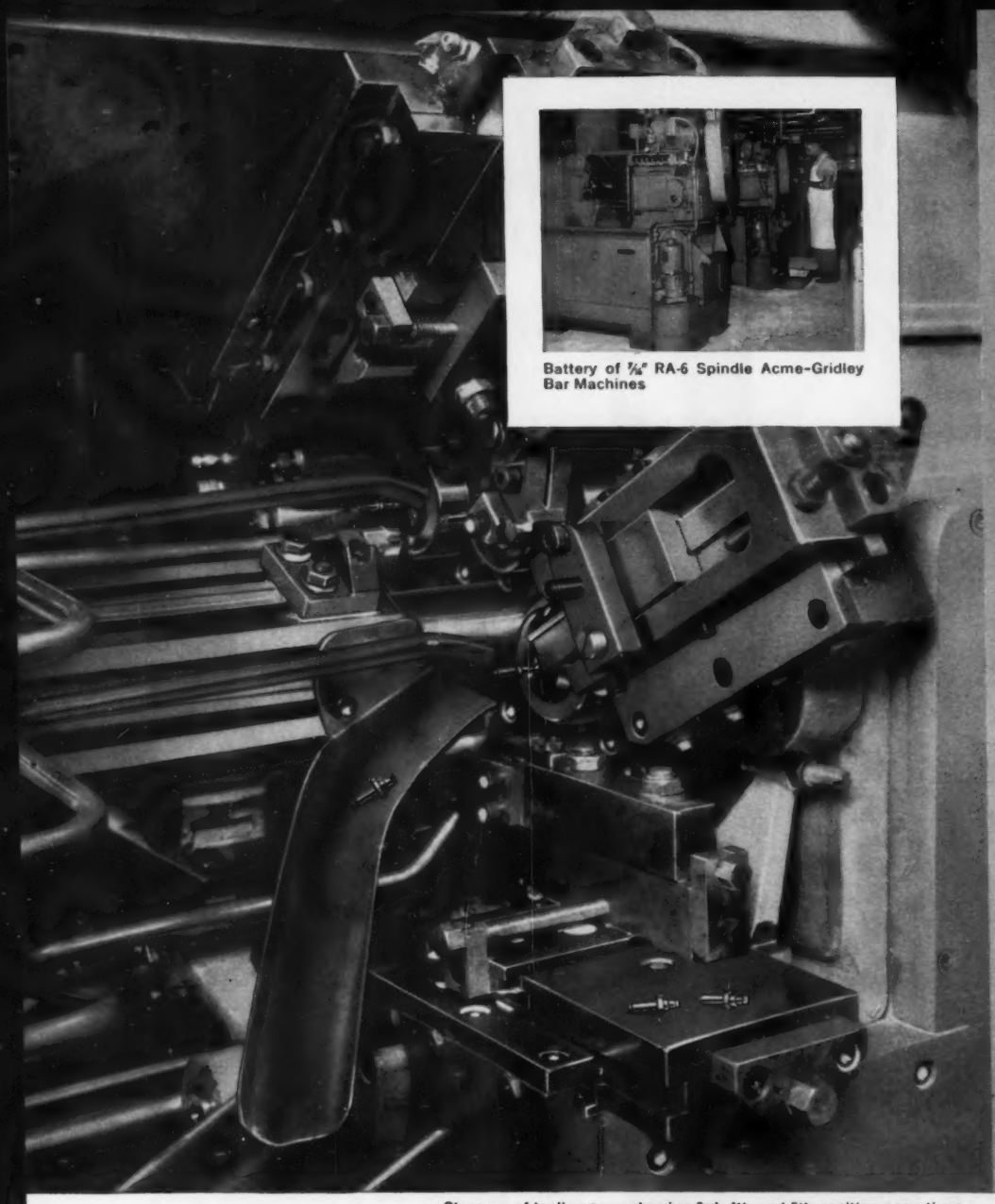





*At Minneapolis Honeywell*

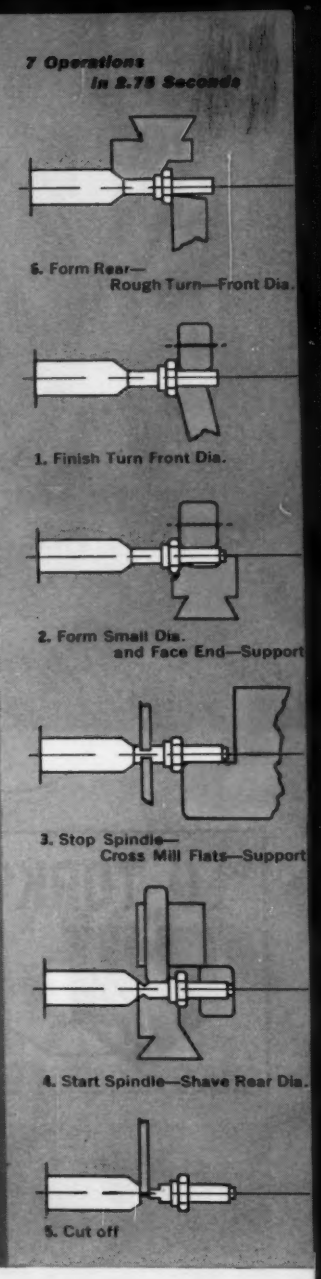
# ONE ACME-GRIDLEY REPLACES FIVE SINGLE SPINDLE MACHINES

*. . . Saves 200% in Machine Hours*





Battery of ⅞" RA-6 Spindle Acme-Gridley Bar Machines




Close up of tooling zone showing 3rd, 4th and 5th position operations

. . . *in addition* the reject rate is reduced 200% and operator hours slashed 300% in the production of a precision center post component for residential thermostats. What's more, with one machine, one set of tools, and one operator doing all machining in the primary setup, quality control is greatly simplified, and valuable floor space saved. Still further savings result from greatly reduced machine maintenance.

Such drastic savings are possible for Minneapolis Honeywell because of inherent Acme-Gridley features such as independently operated tool slides, the extreme accuracy and flexibility of direct camming, and wide open tooling zones. Rugged and versatile 7/16" Acme-Gridleys fit right in with Honeywell's program of "Total Machine Utilization"; will pay off for years to come by economically accommodating the materials and setups Honeywell requires in the production of small, high quality parts for their precision instruments.

Get the complete story on how Acme-Gridley Automatics provide industry's most modern approach to cost reduction. Call, write or wire.

Pioneer in Circumferential Automation

**National Acme**

The National Acme Company
179 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N. J.; Chicago 6, Ill.; Detroit 27, Mich.

# FIRST TIME EVER!

a chip breaking drill that actually improves cutting action — lengthens tool life!




## CHICAGO-LATROBE "LO-TORK" CHIP BREAKER DRILL



**Unretouched photos (above) . . .** dramatic proof of Chicago-Latrobe "LO-TORK" Drill's chip breaking effectiveness. Conventional drill at left; "LO-TORK" at right. Same workpiece in each photo.

Study the tips on the two drills shown above and you will understand how "LO-TORK" Chip Breaker Drills work. A new convex shape has been engineered into the flutes. Chips meet this shoulder and are reduced instantly to manageable size without sacrificing any of the efficiency of the tool's point. At the same time the tool produces extra benefits as follows:

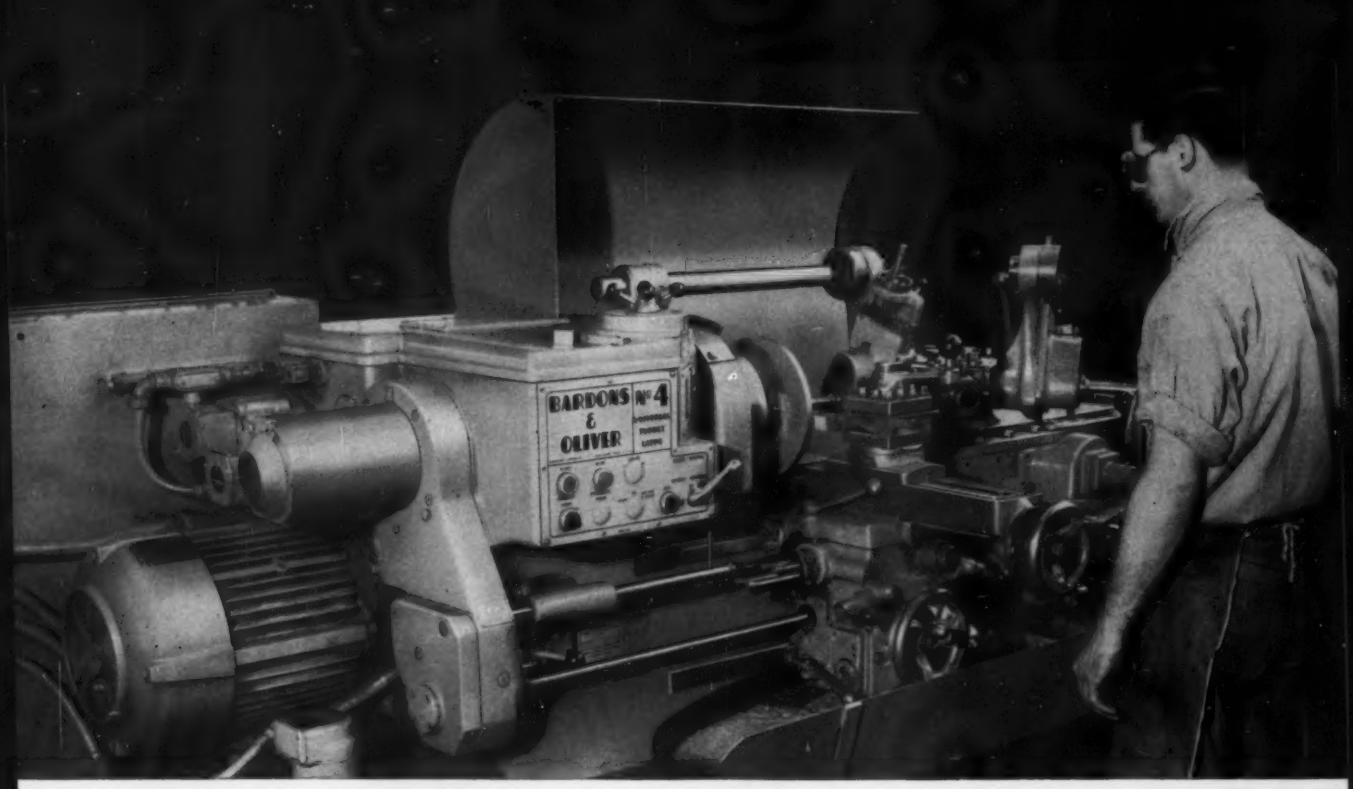
**1.** Improved lubrication at drill point.
**2.** Uninterrupted deep hole drilling.
**3.** Faster feeds. **4.** Longer tool life.
**5.** New safety for operators.
**6.** Quick, easy regrinds. **7.** Less power required.
**8.** Improved plant housekeeping.

"LO-TORK" is a Chicago-Latrobe exclusive, and can be supplied in any regular or special length.

Ask your Distributor
**OR CIRCLE NUMBER FOR FREE BOOKLET.**

## CHICAGO-LATROBE

**428 West Ontario Street, Chicago 10, Illinois**




## BARDONS & OLIVER NO. 4 TURRET LATHE

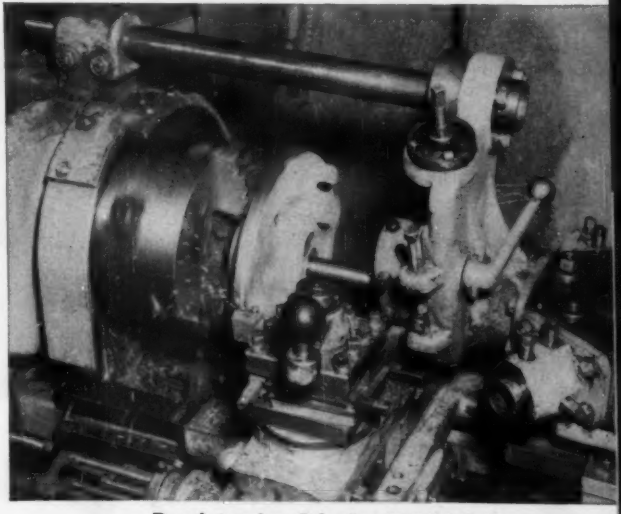
# "Biggest Money-Maker in the Plant"

Reports W. W. McCain, Jr., Factory Manager, Chicago Machinery Laboratory, Inc. This progressive firm manufactures automatic signature feeders and magazine trimmers. Mr. McCain further states:

*"The addition of the No. 4 Bardons & Oliver has allowed us to reduce direct labor in the turret lathe department, and at the same time increase output by 50%. Over 600 different parts are made on the machine. Extreme accuracy of the No. 4 allows us to hold bearing diameters within ±.00025"; at the same time high spindle speeds, heavy feeds, and combined and multiple cuts allow full utilization of the 15 HP main drive motor. The machine is very convenient to setup and operate. During two years of 100 hours a week operation, downtime on the No. 4 has been negligible.*

*We feel that the Bardons & Oliver No. 4 is the most compact and efficient turret lathe available having 18" swing over the bedways. By making a totally different turret lathe for each range of work, Bardons & Oliver offers just the right size machine for any job."*

Your Bardons & Oliver representative will welcome the opportunity to discuss with you the profit possibilities offered by these turret lathes.



*Rough turning & boring 11-1/2" O. D. cast iron cam follower wheel.*

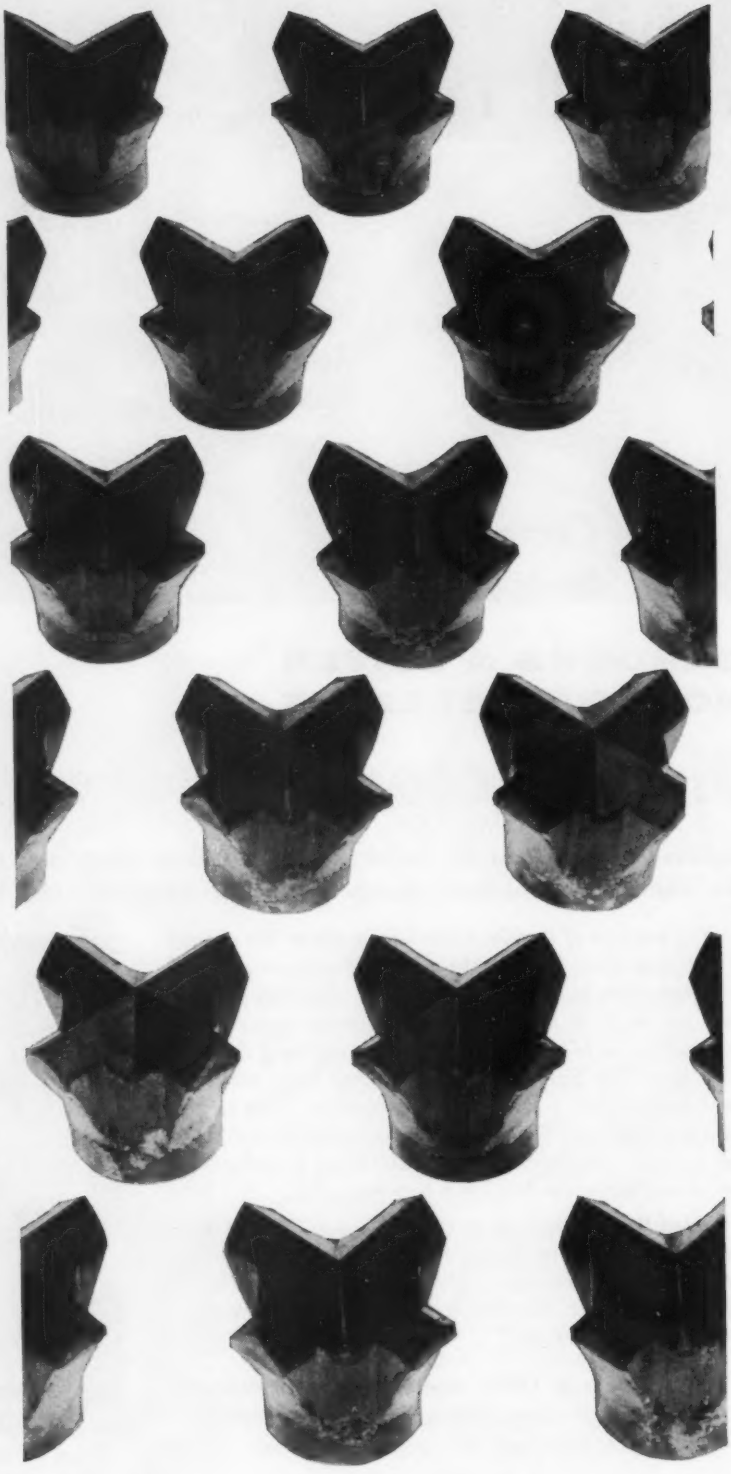
## BARDONS & OLIVER

**BARDONS & OLIVER, INC., 1133 WEST 9th ST., CLEVELAND 13, OHIO**

Manufacturers of Turret Lathes and Cutting-Off Lathes

*From heat to heat...*
*bar to bar...order to order...*

# TIMKEN® STEEL GIVES YOU UNIFORM FORGING QUALITY THAT SAVES YOU MONEY



You can get money-saving, uniform forged quality in *your* products just as fine as that in the rock bit forgings pictured here. They're made from Timken® steel forging bars. And the photograph of the bits is not retouched.

Savings are yours because Timken steel is uniform from heat to heat, bar to bar, order to order. It never varies in structure, chemistry or dimension. And because Timken steel is so dependably uniform, you don't have to interrupt operations to adjust your equipment.

Timken electric furnace fine alloy steel is as uniform a forging steel as you can buy because we take extra quality control steps to make it so. One step—a "first" in the U. S. steel industry—is our magnetic stirrer. This assures equal distribution of the alloys, uniform temperature and working of the slag. Another is our unique method of handling orders individually. It enables us to target our procedures to *your* end-use requirements.

Backing all of our operations is our new Metallurgical Research Center. It comprises one of industry's most modern facilities ranging from an experimental melting laboratory and X-ray spectrometer, to one of the industry's finest technical libraries. All these facilities and the expert metallurgists who use them assure you of the finest possible forging steel with uniformity that means better products, greater savings for you.

To get the most from your modern forging operations, specify Timken steel forging bars. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable: "TIMROSCO". *Makers of Tapered Roller Bearings, Fine Alloy Steels and Removable Rock Bits.*

**WHEN YOU BUY TIMKEN STEEL YOU GET...**

1. Quality that's uniform from heat to heat, bar to bar, order to order
2. Service from the experts in specialty steels
3. Over 40 years experience in solving tough steel problems.

# TIMKEN® *Fine Alloy* STEEL



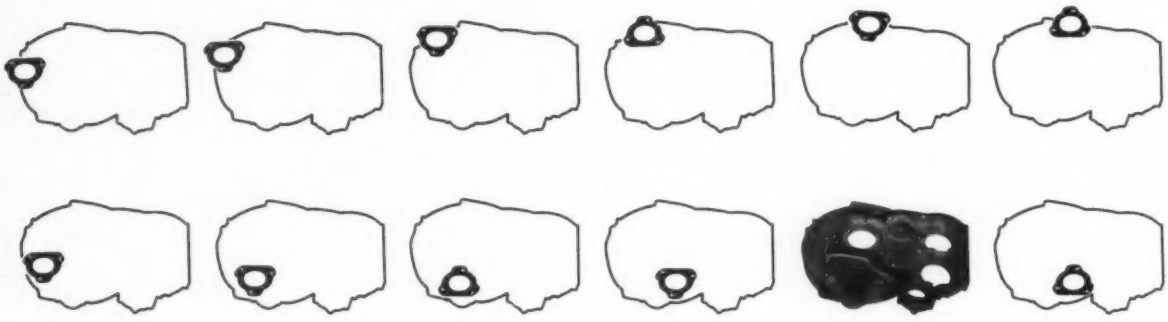
## Right now! Numerical control like this can produce for you

*. . . Turn the page to see how this Natco does it.*

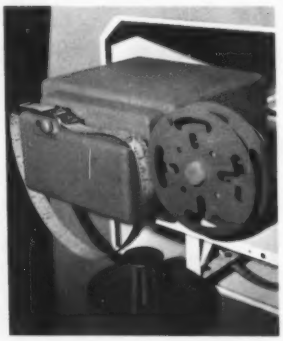
# Tape Control Speeds Production

## This workpiece comes in many varieties . . .

## One multi-spindle Natco machines them all



**Numerical control for the production line?** Sure! And it's paying its way machining starter holes in over 160 different flywheel housings for small diesels. Even though the starter mounting pads are located differently on each of the housings, this Natco handles each new part with equal ease. It bores the hole for the starter pinion shaft; drills and taps three mounting holes around it.



That's the beauty of tape control—the flexibility it gives machine tools like this three column Natco special. Here's practical automation for small lot production!

**It's easy and fast to change to a different part.** Just substitute a new tape loop in the reader and rotate the drillheads to the new setting. In minutes you're cutting metal again.

**No battery of expensive fixtures** needed with this machine—the tape locates the part under the drillheads by controlling the motion of the worktable. And inventory can be cut to the bone because even small lots of service parts are run at production part cost.

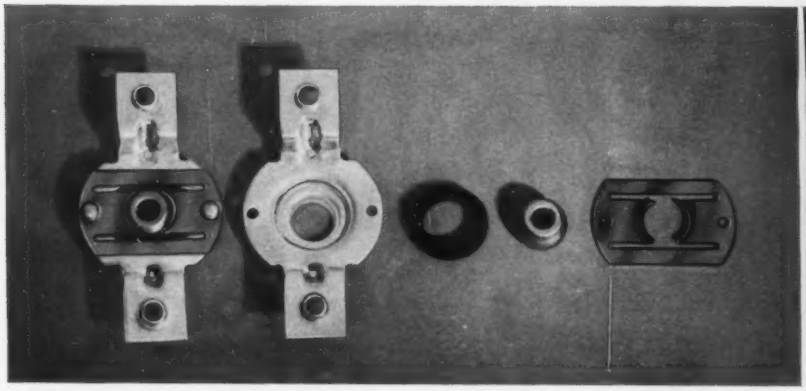
Production lines don't have to wait until tomorrow for numerical control. It's here now, and now is the time to gain the greatest advantage. Let us show you how it can be used to speed your boring—drilling—facing—tapping—reaming jobs. Call your Natco representative today, or write for details.



NATCO NATIONAL AUTOMATIC TOOL COMPANY, INC., RICHMOND, IND.

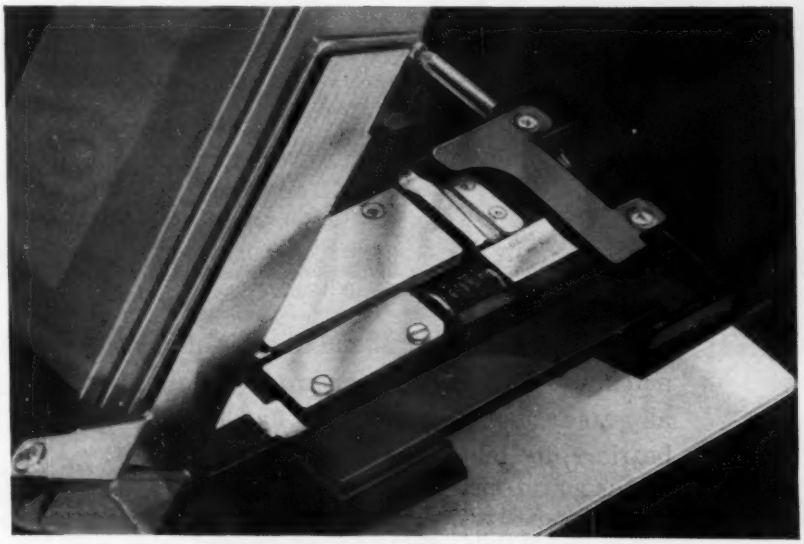
# NEW BRONZE
# CAN CUT SPRING COSTS—

## Superfine-grain phosphor bronze by Anaconda now handling many tough jobs, replacing costlier materials.





**RETAINING CLIP** for a bronze bearing in the Handy Hannah Hair Dryer was originally of spring steel. Rejections ran 20% in the stamping operation and another 20% at the assembly stage. The Handy Hannah Products Corp., Whitman, Mass., switched to Duraflex, Anaconda superfine-grain phosphor bronze, found it had not only the spring quality and fatigue resistance needed for the job—but also had superior formability which eliminated rejections.



**SPRING CLIP** takes a steady beating as it holds invoices in place in imprinting machines—used widely in handling charge accounts by retail stores and service stations. In the imprinter (right) made by the Farrington Mfg. Co., Needham Heights, Mass., this clip was originally of beryllium copper. Hearing about the superior fatigue life and endurance limit of Duraflex, Farrington consulted Anaconda technical specialists and decided to try it. Duraflex has been doing the job now for two years, stands up in service, saves $1.50 a pound in material cost.

TESTS by an independent laboratory show that design stresses for Duraflex wire and flat springs can be from 33% to 50% higher than for those made from regular phosphor bronze—yet Duraflex costs no more than regular phosphor bronze. Get the test reports and revaluate all your components requiring spring properties. For copies of these reports or technical help in selecting the right alloy and temper, see your Anaconda representative. Or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 5945

**DURAFLEX®**

SUPERFINE-GRAIN PHOSPHOR BRONZE

A PRODUCT OF

**ANACONDA®**

*Made by The American Brass Company*

## Now you can do <u>both</u> . . .

# SHORT RUNS
# LONG RUNS

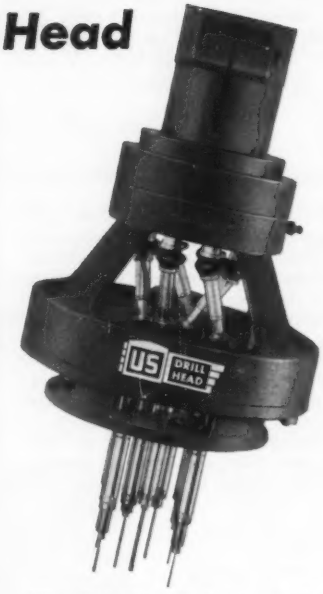
## . . . Drilling and/or Tapping . . .
## with ONE adjustable U. S. Drill Head

Complete versatility for job shop operations with standard adjustable arms . . . or, equip these heads with U. S. Slip Spindle Plates which are jig-bored for positive alignment to fit the hole pattern. Eliminates trial-and-error in set up.

Double Duty Tools—when your drilling machine has a reversing spindle, you can drill and tap the same hole pattern with one head.

U. S. Drill Heads are fast and rugged—designed and built for profit-making performance. Positive all-gear drive with shaved gears, anti-friction bearings, and oil-tight housings assure smooth and accurate operation.

*Ask for Catalog AD-57, or send specifications of your requirements.*




Slip Spindle Plates may be jig-bored for more than one pattern of holes.

US DRILL HEAD

Adjustable and Fixed Center Multiple Drilling Heads.
Individual Lead Screw Multiple Tapping Heads.

**UNITED STATES DRILL HEAD CO.**

BURNS STREET • CINCINNATI 4, OHIO




57-74

# Specify Ex-Cell-O standard power units and cut your machine tool lead time

**Today's demand for increased productivity, lower per-unit cost, even on relatively short runs, is being met economically by automatic, single-purpose, high-production machines—consisting essentially of a plain base and one or more Ex-Cell-O Quill-Type Hydraulic Power Units. Their flexibility allows them to be used over and over again, spreading their initial cost over many productive years.**

**These standard, self-contained Ex-Cell-O Hydraulic Power Units are now being used for: drilling, counterboring, spot facing, reaming, as well as prime movers for milling equipment. With multiple spindle head attached to quill flange, multiple operations may also be performed.**

**For the full story on the cost-saving advantages Ex-Cell-O Self-Contained Power Units offer your short- or-medium-run production requirements—get in touch with your local Ex-Cell-O Representative. Or, if you prefer, write direct to Ex-Cell-O, Detroit.**

***Style 22—8-inch Stroke; Style 22-L—12-inch Stroke**

**EX-CELL-O CORPORATION** *Machinery Division*
**DETROIT 32, MICHIGAN**

**MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT**

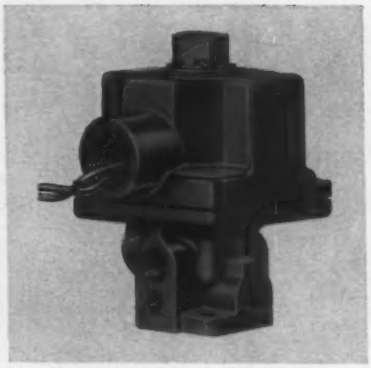


**For more data, circle this page number on inquiry card** 125

# For versatile Cylinder Control, specify Skinner 3- and 4-way Solenoid Valves



**For small cylinders . . .** Skinner V5 and V10 air and hydraulic valves. Stainless steel construction. Mount in any position; can be cleaned without removal from line. Pressure ratings to 1000 psi. Available normally open, normally closed, directional control, multi-directional, quick exhaust. Orifice sizes: 3/64" to 1/4".



**For medium cylinders . . .** Skinner 3 way A Series valves. A new line that can also be used to operate smaller cylinders calling for increased cycling speeds. Die-cast, zinc body; stainless steel internal parts; mount in any position. Available normally open, normally closed, directional control. Pressure to 125 psi; orifice size, 5/32".



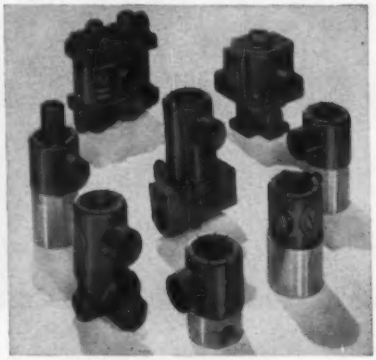
**Coming soon . . . for larger cylinders!** A new-design, general purpose, high-flow industrial line of 3-way solenoid valves. These new valves will be available in orifice sizes of 3/8", 1/2" and 3/4" and will be offered normally open, normally closed, or directional control in standard and explosion-proof construction. Operating pressures: 5 to 150 psi.



**For double-acting cylinders . . .** Skinner 4-way V9 valves. Two 3-way valves in one housing offered normally closed-normally closed, normally open-normally open, and normally closed-normally open. Available with adjustable flow features for exceptional cylinder control. Orifices: 3/64" to 1/8". Pressure ratings to 200 psi.



**Exhaustive lab tests** assure that you can use any Skinner valve with confidence. Built to the highest UL standards, Skinner valves are completely tested and checked to provide the best product available. Skinner's testing standards meet or surpass those of the aircraft industry.



A complete line of 2-, 3- and 4-way solenoid valves. There's a Skinner valve for almost any flow application with a wide variety of media: air, oil, water, inert gases, hydraulic fluids, kerosene and gasoline. Orifice sizes range from 3/64" to 1". Pressure ratings range from vacuum to 3000 psi. Explosion-proof models are UL approved for Class 1, Group D and Class 2, Groups F and G.

*Skinner solenoid valves are distributed nationally*

For complete information, contact a Skinner Representative listed in the Yellow Pages or write us at Dept. 550.

SKINNER ELECTRIC VALVES

THE CREST OF QUALITY **THE SKINNER ELECTRIC VALVE DIVISION • NEW BRITAIN, CONNECTICUT**

- BDSA Controls Dusted Off
- Stockpile Program Revisions Planned
- Air Force to Review Contract Services
- Two Naval Bureaus Consolidated
- Small Business Role Reviewed



# Keeping up with Washington

**Loring F. Overman**

The Business and Defense Services Administration still has control procedures which it can take out of mothballs in an emergency. This became apparent when BDSA administrator H. B. McCoy told a Congressional Committee about a simplified Defense Materials System. Nearing completion, he said, the new regulations would be ready to be made public "perhaps when the steel strike is over."

Administrator McCoy indicated that if the steel strike were prolonged, several actions might be necessary to protect defense production. BDSA could, he said, (1) freeze warehouse stocks for defense purposes when stocks of defense-rated items reach 50 per cent of the prestrike inventory; (2) increase to 15 per cent or even 25 per cent the defense "set-asides" of mills not affected by the strike; (3) increase spot assistance to particular contractors "by getting somebody else not normally in the business" to supply the needed items; and (4) freeze the Government's normal operating inventory of steel for defense-rated programs.

Concerning the new regulations, the BDSA chief said that the simplification eliminates paper work for a large number of subcontractors while requiring government agencies to keep precise data as to our industrial resources and as to how much of our materials are going into military and atomic energy programs (including the space program).

## Stockpile Program Revisions Planned

Legislation to give the Office of Civil and Defense Mobilization greater flexibility in disposing of government stockpiled material has been asked by OCDM director Leo A. Hoegh. The plan would consolidate five present stockpiles into two—a strategic or national stockpile and a reserve—and would reduce the stockpile from a five-year concept to a three-year period.

Of seventy-five stockpiled items, sixty-nine are in ample supply or surplus on the basis of the three-year concept, although the Government is still obligated to purchase some $865,000,000 worth more under existing stockpiling orders.

## Air Force to Review Contract Services

Contract services for the Air Force—including the operation of facilities—are to be reviewed under terms of a new regulation. The regulation provides new guide lines that specify when the Air Force may or may not employ nonservice sources. Economy and effectiveness are cited as the principal determining factors, but the new regulation appears designed to tighten Air Force management control of contract functions, while permitting their use under specified conditions.

When not otherwise prohibited, the use of contract services is permitted "when such use will be in the best interest of the Air Force and the Nation, and when one of the two following conditions applies: (a) when such use will improve efficiency or economy, or (b) when adequate in-service skills will not be available to perform necessary work."

## Two Naval Bureaus Consolidated

Establishment on September 1 of a new Bureau of Naval Weapons, with Rear Admiral Paul D. Stroop as chief, has been announced. The new bureau is a consolidation of the Navy's Bureaus of Ordnance and Aeronautics. The merger should bring about a unified approach to the development of weapons systems, rather than two parallel approaches which, particularly in the missile field, have been common under the current two related bureau systems.

Four operating areas, each under an assistant chief, will be: (1) research development and evaluation; (2) procurement and production; (3) fleet readiness; and (4) field support. No immediate change is contemplated in the 350 field establishments under the two existing bureaus. When reorganization is complete the new bureau will employ more than 4400 military and civilian personnel at the department level, with a total, including worldwide establishments, of more than 200,000 persons.

## Small Business Role Reviewed

Further efforts are being made to increase the participation of small business firms in Air Force Research and Program Development activities. During the first six months of 1959, according to the Air Research and Development Command, 521 out of a total of 1397 research and development contracts were placed with small business firms for a total value of $29,129,848. During the same period, of 1038 support contracts, 669 contracts valued at $10,063,872 were awarded to small firms.

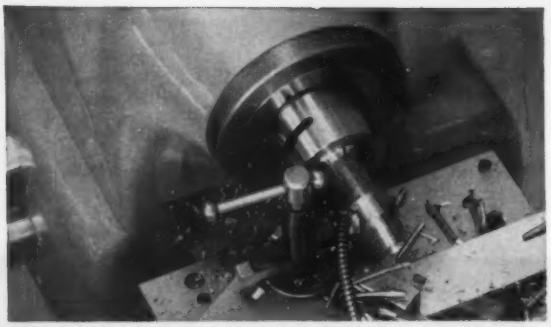
## Washington Briefs

**Corrosion Manual** for personnel engaged in construction, operation, and maintenance of naval shore facilities has been published by the U. S. Navy Bureau of Yards and Docks. Entitled "Corrosion Prevention" (PB 151756), the 431-page manual may be purchased for $6 from OTS, Department of Commerce, Washington 25, D. C.

**National Defense** for fiscal 1960 will be conducted on the basis of a budget of $39,228,239,000—1/20 of 1 per cent less than the Administration requested. Distribution: $9,300,000,000 for the Army, $11,000,000,000 for the Navy, $17,400,000,000 for the Air Force, and $1,300,000,000 for the Office of the Secretary of Defense.

HARDINGE
ELMIRA, N.Y.

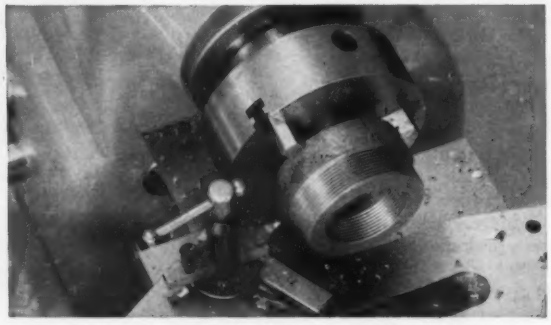
# "The Outstanding Tool Room Lathe"



Precision Collet work for all sizes to 1-1/16" Collet seats *directly* in spindle.



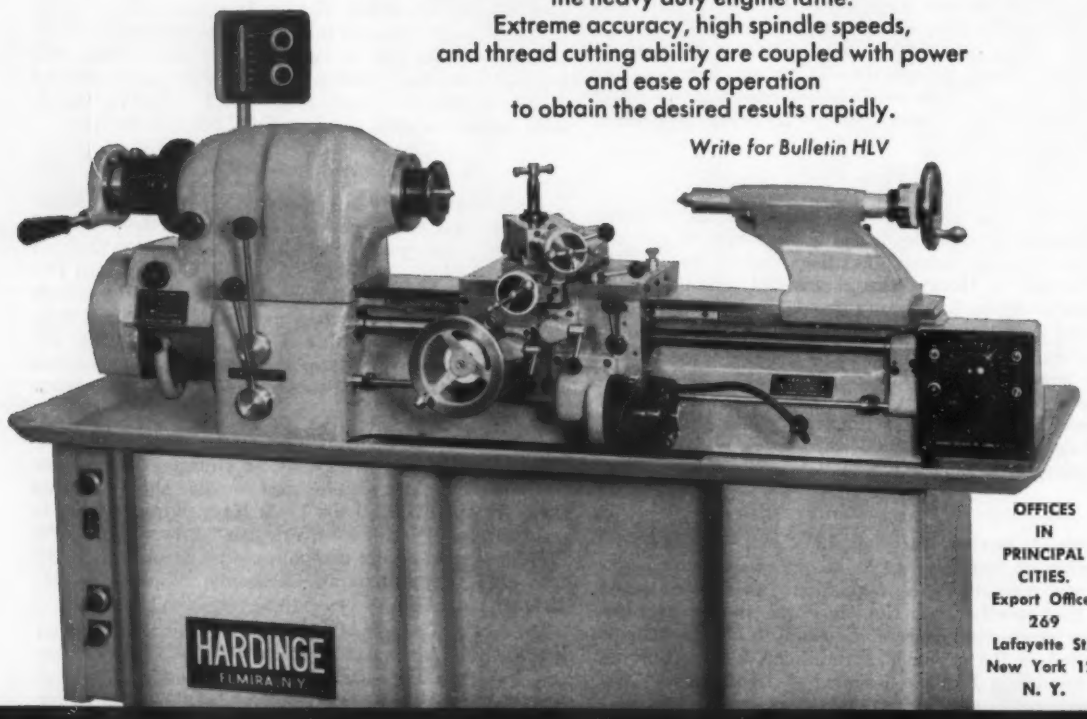
Precision Step Chucks for diameters up to 6". Provides Collet-like accuracy.



Integral Mount Jaw Chucks for precision holding of regular or irregular shapes up to 5".

**Hardinge Model HLV 10" Lathe** was primarily designed to fill a very old existent gap between the plain precision bench lathe and the heavy duty engine lathe.
Extreme accuracy, high spindle speeds, and thread cutting ability are coupled with power and ease of operation to obtain the desired results rapidly.

*Write for Bulletin HLV*




OFFICES IN PRINCIPAL CITIES.
Export Office: 269 Lafayette St., New York 12, N. Y.

**HARDINGE BROTHERS, INC., ELMIRA, N. Y.**

# *You Can Now Be a Military Expert*

QUALIFIED CIVILIANS in business, industry, and the professions are being urged by the Industrial College of the Armed Forces to take a proffered correspondence course that covers the economics of national security. The purpose of this course is to educate civilians, as well as selected officers of the reserves and regular services, in the interdependence of the economic and military structures. Participants in this course will study the economic readiness of nations to wage war and analyze economic, military, political, and psychological factors as they relate to the security of our country.

A communique received from the Commandant of the Industrial College points out that in the past the United States, when threatened by armed aggression, could mobilize its manpower and economy at relative leisure. Our major wars were fought on foreign soil; the homeland was spared the destruction of battle areas. The communique then emphasizes the fact that today's thermonuclear weapons and high-speed delivery systems have invalidated the traditional concepts of mobilization. Bygone fighting methods might be passé in any future conflict, and the war could be brought within our borders.

National security in this modern age is therefore a matter of constant preparedness. Every aspect of our national existence—military, economic, and political—should be ready to react instantaneously to an enemy attack. To do this effectively it is essential that leaders at all levels of our society, particularly within our vast and complex economic system, understand the threat we face and the measures we must be prepared to take to insure our national continuity.

The correspondence course is aimed to achieve this end. It is based on the curriculum of a ten-month resident course that is conducted for selected senior military officers and executives of government civilian agencies. Members of the Industrial College faculty review each test paper submitted, and answer individual questions. The entire course takes about one year to complete. Here is the opportunity to become a military expert, "free for nothing"! Over 3600 students are already enrolled.

Charles O. Herb

EDITOR



Vertical milling operation at Fluid Packed Pump Co., Los Nietos, Calif.

# SAVE...

## with fast-machining steels from Ryerson

It will pay you to let a Ryerson representative help you select the steel best adapted to your operations. The Ryerson man can document cases of improvements up to 50% in parts machined per hour . . . of increases in tool life of 300%.

The nation's largest stocks of fast-machining steels of every type, including the carbon, alloy and stainless steels listed at right, are on hand at Ryerson ready for quick delivery. Call the Ryerson plant near you.

**FREE-MACHINING STEELS IN STOCK**

**Ledloy® steels & screw stock**—Ledloy rounds up to 4", squares up to 1½" and hexes up to 3". Also on hand—all your requirements for C1213, MX1213, and leaded and non-leaded C1117 and C1141.

**Carbon steel tubing**—All the sizes and wall thicknesses used by automatic screw machine shops are ready for shipment, including the new Ryerson development, lead-bearing seamless mechanical tubing.

**Alloy bars**—Complete selection of leaded alloys, including the Rycut® steels—fastest machining in their carbon ranges.

**Stainless bars and tubing**—Here, too, our stocks are the nation's largest including easy-machining Types 303 and 416 in rounds, hexagons and squares.

**Carbon steel plates**—New E-Z-Cut® Plates (Hot Rolled, Low Carbon Manganese).

RYERSON CERTIFIED QUALITY

**RYERSON STEEL®**

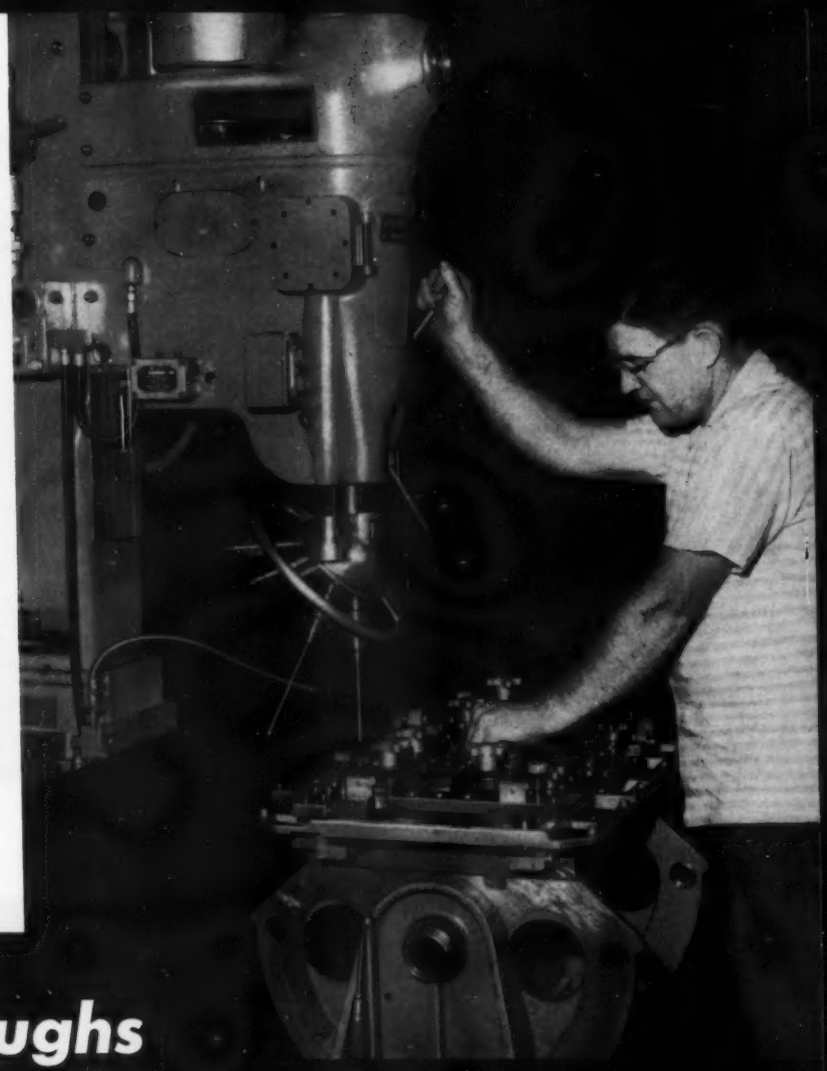
Joseph T. Ryerson & Son, Inc., Member of the INLAND® Steel Family

*STEEL • ALUMINUM • PLASTICS • METALWORKING MACHINERY*

*NATION'S MOST COMPLETE SERVICE CENTERS IN PRINCIPAL CITIES COAST TO COAST*

RUSS HERRIGES, General Superintendent
Manufacturing and Engineering
Plymouth Division
Burroughs Corporation
Plymouth, Mich.

**Unusual and close - tolerance stamping, broaching, drilling, and finishing operations employed to produce high-quality parts for a wide variety of business machines**



# How Burroughs Builds Better Business Machines

A DYNAMIC GROWTH has been experienced by the Burroughs Corporation in developing better methods of handling and processing figures and information. Products have expanded from six basic lines of business machines to a wide range of devices and systems in the fields of electromechanics, electronics, and magnetics. Included among the company's products are adding, bookkeeping, accounting, and ticket-issuing machines; electronic computers; and defense components.

Manufacturing methods and techniques are continually being developed and improved to increase efficiency, improve the products, and strengthen the company's competitive position. Some of the more outstanding operations being performed in manufacturing various business-machine parts are described in this article.

Considerable savings are being realized and higher quality rack bars are obtained by stamping the parts from pretempered SAE 1070 steel stock on a progressive carbide die, Fig. 1. These intricate parts are about 12 1/2 inches long by 0.035 inch thick, and have fifty-nine teeth of 15 diametral pitch along one edge. Most dimensions are held within plus or minus 0.002 inch.

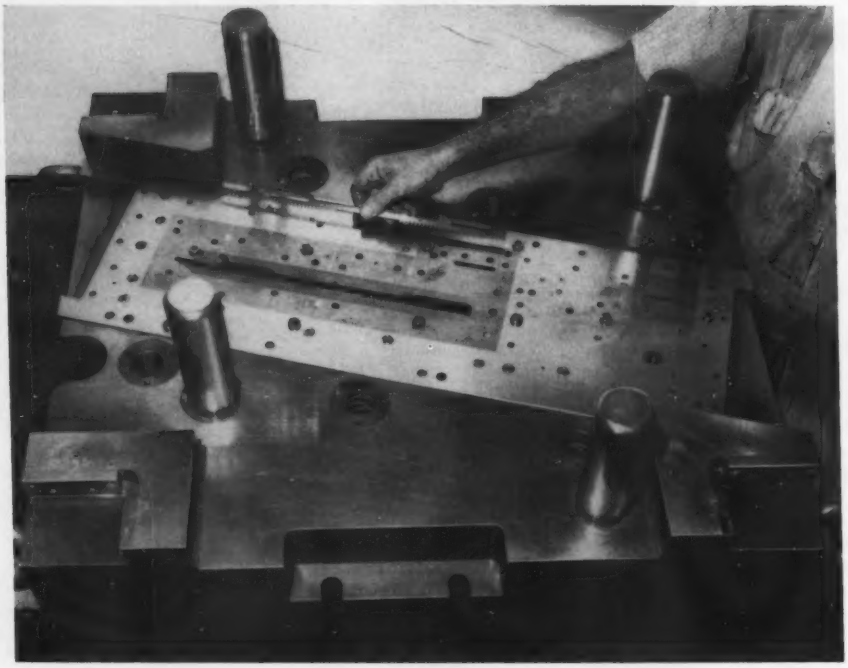


Fig. 1. Die for stamping rack bars from pretempered stock. Use of carbide tools eliminates need for heat-treating, straightening and shaving parts.

Previously, the racks were blanked from cold-rolled steel. This necessitated subsequent heat-treatment, which resulted in considerable distortion and difficulty in holding the tolerances specified. Straightening of the hardened racks was required, and scrap amounted to as much as 30 per cent. Also, the parts had to be deburred and the gear teeth shaved.

Now, subsequent heat-treatment (except for induction hardening of a small area on each part) and straightening are no longer required. The finish on the gear teeth is better than that previously obtained with subsequent shaving, and deburring of the stamped racks is not necessary. The roller-leveled, pretempered stock now used has a hardness between 42 and 46 Rockwell C. Stamping is performed on a Bliss 200-ton press operating at eighty strokes per minute, and scrap has been practically eliminated.

While the raw-material costs are higher and the carbide dies more expensive than the stock and tools used previously, these disadvantages are more than offset by the elimination of heat-treatment, straightening, deburring, and shaving operations, as well as the increased die life and savings in scrap charges. The total production time has been reduced to about one-tenth of that formerly required, and the cost cut approximately 78 per cent. Die life between the sharpenings has been increased from an average of about 6000 to 26,000 parts, and as many as 116,000

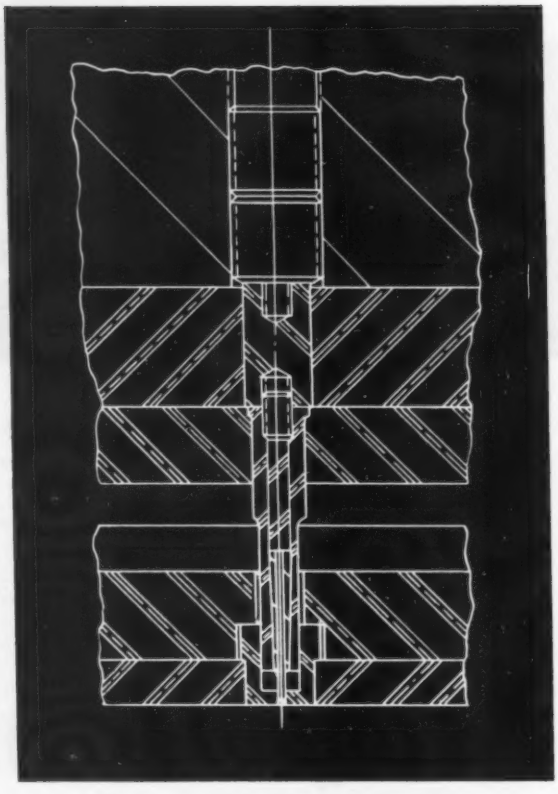


Fig. 2. Quill type design of carbide punch permits easy replacement with standard components.



Fig. 3. Dial-feed attachment improves safety and has increased production 167 per cent in forming small parts in this press operation.

racks have been produced before the carbide die requires sharpening.

The original design of the progressive carbide die has been modified, based on experience, to include heel plates, additional larger-diameter guide pins, and increased-size carbide inserts. Hardened steel backup plates are used behind the punches and dies, and the die shoes are made of cast Meehanite. Punch and die clearances are held to 5 per cent of the stock thickness, and the stripper-guide clearances are maintained within 2 1/2 per cent of the stock thickness. The quill type punch design illustrated in Fig. 2 has saved considerable cost by facilitating the replacement of broken or worn punches with lower-cost, standard cylindrical components.

### *Dial Feed Speeds Press Output*

Forming of small stampings on the Minster 32-ton press seen in Fig. 3 has been boosted 167 per cent by adding a Feed-O-Matic dial-feed attachment made by the V & O Press Co. Also, safety of the operation is improved, since the operator is seated well in front of the press and merely places blanks in the nests on the rotary indexing table. Another benefit is longer die life resulting from a safety switch that automatically stops the press if more than one blank is loaded in a nest. The turntable has eight work-holding nests, and can be rotated at variable speeds.

Stampings to be formed are automatically picked up from the nests one at a time by the vacuum head on a cam-operated, spring-loaded pivoting arm. When the arm has swiveled into loading position, the stamping is dropped into the die. As the arm returns, the press ram is lowered to form the part. When the ram is raised, the finished stamping is ejected from the die by air pressure. If the operator omits placing a part in one of the nests, there is no interruption of the automatic cycle. A total of nine different setups on five different parts are performed with the same dial-feed attachment.

### *Broaching of Spacing Racks and Type Magazines*

Improved quality, faster production, and lower cost are the direct benefits of changing from milling to broaching of the slots in type magazines and spacing-rack bars for sensing panels. The type magazines, which are approximately 2 1/4 inches long by 1/2 inch wide and 0.085 inch thick, have twelve slots cut along each side and one center slot along the length. The side slots are 0.125 inch long by 0.100 inch wide and 0.040 inch deep. A tolerance of plus or minus 0.0005 inch is maintained on the slot lengths.

Previously, the type-magazine slots were milled, with subsequent deburring required. Production time per part was reduced two-thirds on the Detroit Broach 5-ton, 30-inch stroke machine seen in Fig. 4, and deburring is not required. The one broaching machine has replaced four milling



Fig. 4. Broaching of slots in type magazines results in increased production and better surface finish. Also, need for subsequent deburring was eliminated.

machines, and resulted in substantial savings both in production and maintenance costs. The specified surface-finish requirement of 54 micro-inches was difficult to maintain with milling, but a finish between 20 and 35 micro-inches is consistently obtained in broaching.

The broaching machine is provided with a trunnion type fixture having four stations, and two type magazines are completed per pass. Broaching tools are made of M-2 type, molybdenum-tungsten high-speed steel, hardened to between 64 and 66 Rockwell C. The ram is operated at 34 feet per minute, and each tooth broaches to a depth of about 0.0014 inch.

Spacing racks are made from 0.0625-inch-thick sheet steel. They are 3/4 inch in width and vary from 19 3/4 to 23 3/4 inches in length. From 177 to 221 slots are required along both edges of each rack—the slots are 0.096 inch deep and vary from 0.050 to 0.0625 inch in width. Edges of the racks must be held straight and parallel within 0.004 inch, and opposing teeth (on opposite edges of the same rack) must be aligned within 0.002 inch. A tolerance of plus or minus 0.001 inch on the spacing from one tooth to the next is noncumulative.

In milling these slots, both sides of each part required deburring. Now, they are broached ten at a time on the Detroit Broach 15-ton machine seen in Fig. 5. Production time per part is about one-ninth that formerly required. Also, only two (top and bottom pieces) of the ten racks per load have to be deburred. One week's production from the broaching machine takes care of about six months' requirements for spacing racks. Previously, one milling machine had to be operated full time to keep up with demands.



Fig. 5. From 177 to 221 slots are cut along both edges of each spacing rack on this broaching setup, and ten racks are broached at a time.

### *Multiple-Spindle Drilling and Tapping*

Time required to drill, ream, chamfer, counterbore, and tap various holes in the tie-bars for Sensimatic machines has been reduced from 40 to 75 per cent—the exact time saved depending on the particular style tie-bar being processed. All four styles of tie-bars, which are made from SAE 1008 steel and measure 11 inches long by 3/8 inch wide and 3/4 inch high, are handled on the group of five Natco multiple-spindle machines seen in Figs. 6 and 7. Four of the auto-



Fig. 6. Two of the five multiple-spindle machines used to drill, ream, chamfer, counterbore, and tap various holes in tie-bars for Sensimatic machines.

matic cycling machines are used for drilling, reaming, chamfering, and counterboring, while the fifth (shown at the center in Fig. 7) is employed for tapping. Previously, six multiple-spindle machines were used, and two more would have been required to meet production needs.

Two of the four drilling machines are each equipped with twenty-seven spindles, and are used for processing two of the four styles of tie-bars. The other two machines each have twenty-three spindles, and process the remaining two parts. All four parts are processed on the common tapping machine, which has eighteen spindles. Each machine has an automatic, hydraulically operated indexing table—the four drilling machine tables having six positions, and the tapping machine, four positions. Also, all machines are provided with selector switches—one switch for each two positions of the indexing table—that can be set to perform any of the operations for which the machine was designed. This facilitates using the machines for the production of many different parts. Also all machines are provided with a slip-spindle plate and slip type spindles for quickly changing the setups when required.

On the drilling machines, the tie-bars are manually loaded and clamped—one movement of the clamp-actuating handle securing two parts in fixtures such as the one seen in Fig. 8. On the tapping machine, the work-pieces are clamped by spring pressure of the head. Machine tables and fixtures are hydraulically raised to feed the work-pieces into the rotating tools in these applications. This has been done, instead of feeding the machine heads and tools downward, as in conventional practice, because the tables, fixtures, and work are lighter and thus easier to move.



Fig. 7. Multiple-spindle tapping machine (center) and two drilling machines employed to complete the holes in four different styles of tie-bars.

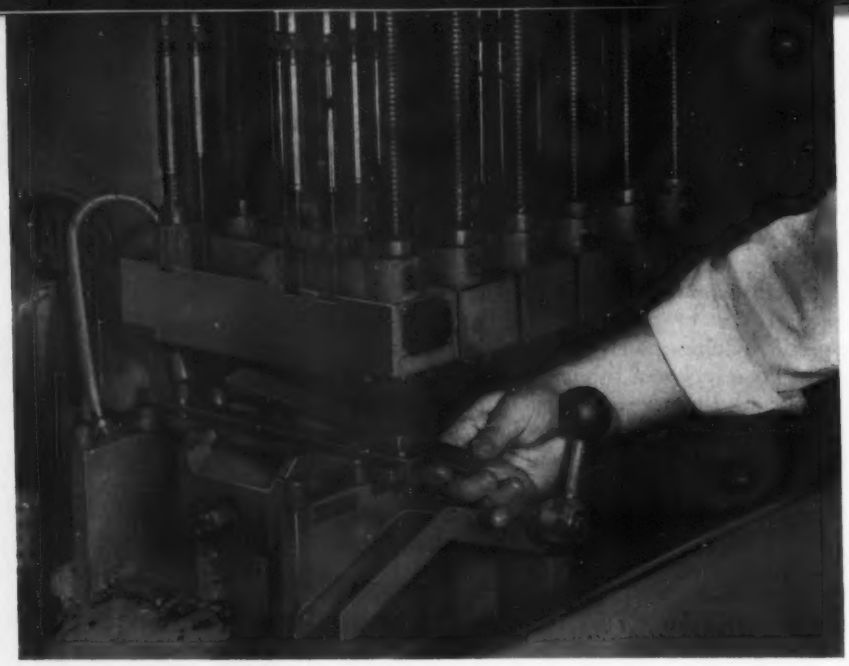


Fig. 8. Fixture on multiple-spindle drilling machine supports two work-pieces, which are manually loaded and clamped in place.

### *Turret Drilling Machine with Air-Operated Fixture*

Drilling, reaming, counterboring, and tapping of cast-aluminum typewriter chassis are now done on the Howe & Fant turret machine seen in the heading illustration. (Howe & Fant machines are now made by the Brown & Sharpe Turret Drilling Division, Inc.) Previously, when two machines were being used, each with an individual operator, less than half as many parts were produced than with the present method. Also 83 square feet of floor space has been saved and subsequent deburring eliminated.

A special, air-operated fixture is provided on the machine base to facilitate locating the typewriter chassis in the various positions required. The table carrying the bushing plate and work-piece is freely mounted on antifriction bearings, and can easily be moved manually—either longitudinally or transversely—to the approximate desired location. At this point, a foot-treadle actuated, air-cylinder operated shot-pin (located in the base of the fixture and vertically aligned with the machine) enters a tapered bushing in the positioning plate for final locating and locking of the work-piece. A trunnion mounting also permits swiveling the work 90 degrees either side of the horizontal position, as seen in Fig. 9.

The six-position turret is attached to the quill of the machine, and the speed of the turret spindles can be independently set within an infinitely variable range from 200 to 4000 rpm. The hole-positioning plate can easily be changed to suit different parts having various hole patterns.

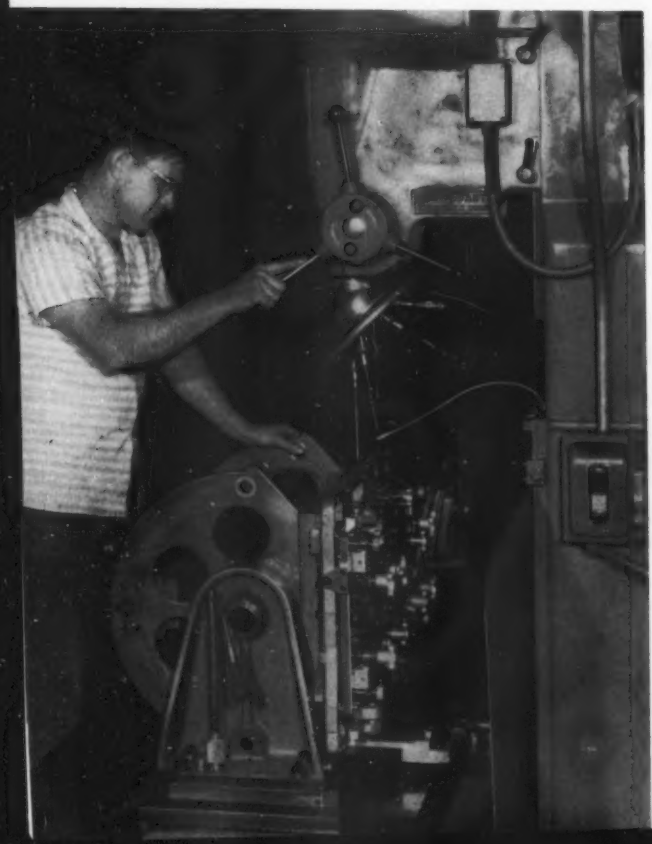


Fig. 9. Air-operated fixture on turret drilling machine facilitates positioning of work-piece, and can be swiveled 90 degrees, as shown.

### *Deburring by Power Brushing*

A specially designed, rotary brushing machine, Fig. 10, has reduced the time needed for deburring type used in various business machines by 62.5 per cent. Formerly, it was necessary to hand-file the four edges on each part with a specially grooved tool, and use a special fixture. The pedestal-mounted, rotary brushing machine consists essentially of an electric motor-driven, Geneva-



Fig. 10. Machine equipped with indexing reel and two wire brushes has cut time required for deburring type by 62.5 per cent.

wheel indexing reel having six work stations. Two motor-driven wire brushes, mounted 120 degrees apart, are located behind the reel.

Work-pieces are manually loaded, one at each station, between rubber-faced clamps. As each part is indexed to the first working station, one of the wire brushes (revolving clockwise) deburrs two of the edges. At the next station, the second brush (revolving counterclockwise) deburrs the opposite two edges. Each time the reel indexes, a finished part is ejected into a pan, and the operator loads another part into an empty station.

### *Lapping Jumps Production 1100 Per Cent*

Finishing the end faces on spacer collars with the Norton Hydrolap machine seen in Fig. 11 is accomplished at more than eleven times the speed with two surface grinders previously used. Also, the need for grading and selecting the finished collars has been eliminated because of the closer tolerances that can now be maintained.

Spacer collars are dumped into two Syntron vibratory hoppers—one seen in the center and the other at the right. From these hoppers, the collars slide down chutes and enter nests in two rotary work-carriers, which transfer the parts between opposed upper and lower, bonded-abrasive wheels.

The upper wheel finishes the hub faces of the spacer collars, holding the dimension to the inner flange faces to 0.0560 inch, plus or minus 0.0005 inch. This is a resinoid-bond silicon-carbide wheel of 320 grain size and H grade. The lower wheel finishes the outer flange faces, maintaining over-



Fig. 11. End faces of spacer collars are finished at the rate of 4000 per hour on this machine. Thickness is held to a tolerance of plus or minus 0.000030 inch.



Fig. 12. Automated setup for sizing the bores and hobbing the teeth on gear blanks, which are loaded in vibratory hopper at left.

all thickness of the collars within 0.07770 inch, plus or minus 0.000030 inch. This is a vitrified-bond, aluminum-oxide wheel of 120 grain size and L grade. Completed parts drop from the work-carriers through chutes into a pan at the front of the machine. A net production of 4000 collars per hour is obtained.

### *Automatic Ballizing and Hobbing of Gears*

Gear blanks that have been turned, bored, and faced on multiple-spindle automatic bar machines are dumped into a Syntron vibratory hopper seen in front of the inspector at the left in Fig. 12. Here the blanks are automatically oriented (hub side up) and fed down a chute to a Denison 1-ton press, a close-up view of which is seen in Fig. 13.

Final sizing of the gear-blank bores is accomplished by pressing a carbide ball 0.1879 inch in diameter through the bores. This increases the bore diameter by 0.0006 to 0.0010 inch, produces a smooth surface finish, and maintains size within plus or minus 0.0001 inch. After the ball has been pressed downward through each bore by the press ram, it is repositioned for the next cycle by being blown around an enclosed endless track by compressed air.

Gear blanks with finish-sized bores are then automatically conveyed to and loaded in either of the two Barber-Colman hobbing machines shown at the right in Fig. 12. On these machines sixteen involute teeth of 36 diametral pitch and 14 1/2-degree pressure angle are cut on each of the blanks.

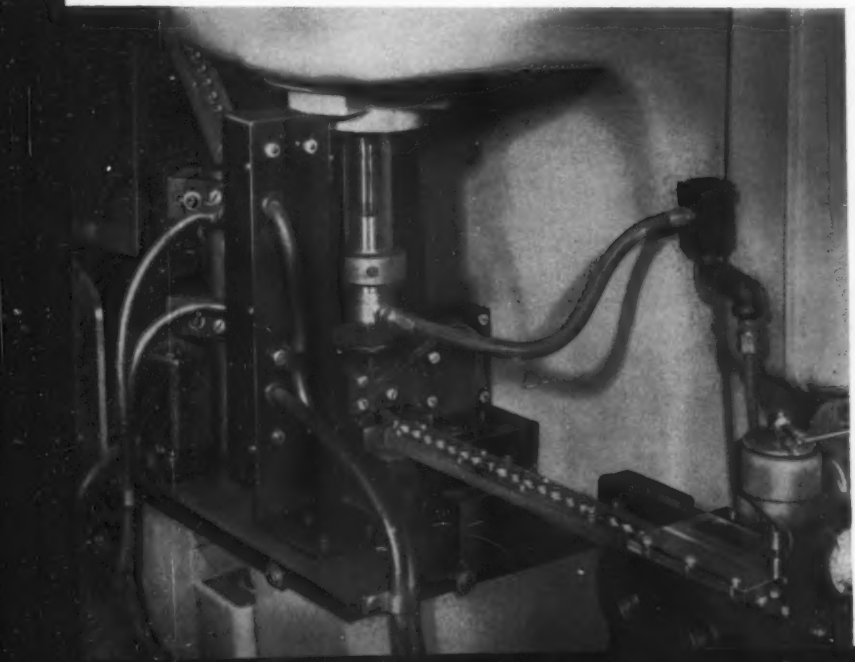


Fig. 13. Close-up view of 1-ton press used in line shown in Fig. 12. Here a carbide ball is pressed through the gear blanks to size the bores.

# Measuring the KINEMATIC ERRORS OF GEARS

M. BARASH and P. OXLEY
Manchester, England

TWO INSTRUMENTS for gaging the kinematic errors of gears have been reported as Soviet developments in mechanical and production engineering. One measures the relative rotation between a standard gear and the gear being tested while they are simultaneously run in mesh with a third gear. The second instrument is designed for checking fine-pitch gears. In this case, the advance of a standard rack driven by the gear under test is mechanically compared with the theoretical advance of the gear as set up on a sine bar.

The instrument shown in Fig. 1 has two coaxial spindles, one carrying a gear *A* to be tested, and the other, a standard gear *B*. In operation, both of these gears are rotated in mesh with an intermediate gear *C*. Kinematic errors of gear *A* cause relative rotation between the two coaxial shafts, and the amount of this movement is transmitted by leverage to the dial indicator *D*.

The assembly which includes the coaxial shafts and gears *A* and *B* is supported in bearings fixed to the base of the instrument. Intermediate gear *C*, however, rotates on a shaft mounted on a slide which can be moved to permit adjustment of the center distance between the gears. The gear to be tested is held on split bushing *E* and a nut *F* secures the assembly on the tapered upper part of the internal spindle *G*. Relative motion between the gears is transmitted to the dial indicator by means of disc *H*, which is attached to the internal spindle, arm *J*, which is secured to the external spindle *K*, and lever *L*, mounted in bearings on disc *H* and lever *M*.

An improvement in accuracy is obtained when the indicating mechanism shown is replaced by

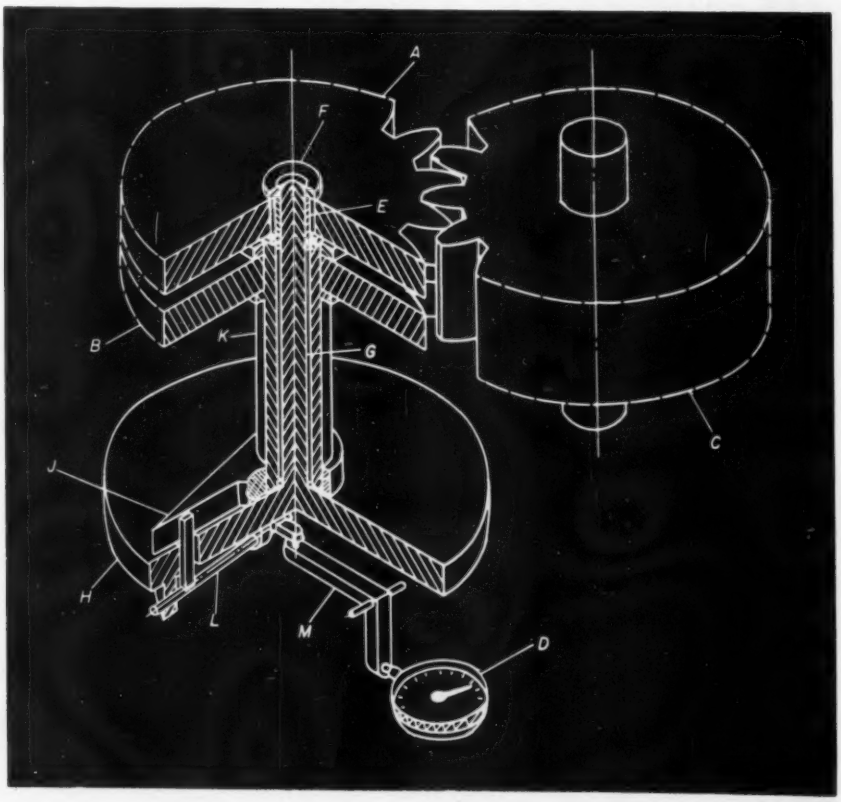



**Fig. 1. Here, the relative rotation between a standard gear (B) and the gear (A) being tested is recorded on the dial indicator (D).**

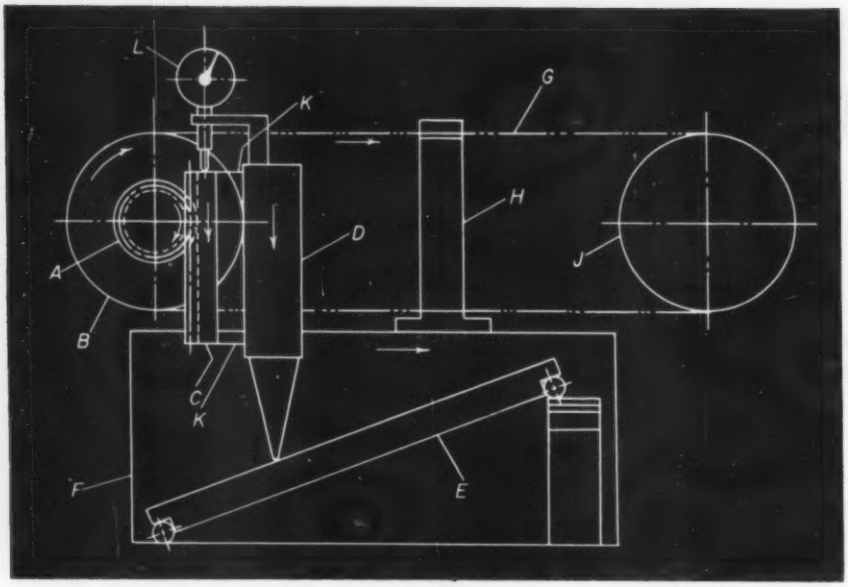



**Fig. 2. In this instrument, any variation in the downward movement of rack (C) and slider (D) is shown on indicator (L) when the gear (A) under test is rotated clockwise.**

an induction pick-up that can measure directly the angle between the coaxial shafts. The pick-up impulse can be amplified and recorded and an accuracy of 2 to 4 seconds of arc obtained.

Kinematic errors in fine-pitch gears of 25 to 130 diametral pitch and up to 3 inches in diameter can be measured with the instrument shown in Fig. 2. In this case, the gear *A* under test is mounted on a shaft with a rolling disc *B*. A standard rack *C* is held in mesh with the gear. This rack, in turn, is mounted on a slider *D* by means of two flat parallel springs. A sine bar *E* is mounted on a second slider *F* which can move at right angles to the rack. In addition, a steel tape *G* is attached to the upper part of member *H* which is fixed to slider *F*. This tape acts as a belt drive and is placed around both disc *B* and a second disc *J*. When slider *F* is moved to the right, the vertical slider *D* descends, remaining in contact with the sine bar.

At the same time, tape *G* rotates disc *B* and the gear being tested is turned the same number of degrees, moving rack *C* downward. Any difference between the downward movement of the rack and that of the slider causes a relative displacement between these members. This displacement, which is made possible by deflection of the two flat-spring connections *K*, is equal to the kinematic error of the gear and is shown on the dial indicator *L*. For proper reading, the pitch line of the rack must be tangential to the pitch circle of the gear being tested.

# Miniature Screw Threads Standardized

Tiny screws have been providing "king-sized" headaches for space engineers and scientists. Thinner than a fine needle, they are vital components of the delicate instruments and controls in missiles and rockets. Until recently, there were no standard screw sizes of such Lilliputian dimensions, and engineers had to design their own screws for every new instrument.

Now, a solution has been reached for this problem. A publication called "American Standard Unified Miniature Screw Threads, B1.10-1958" has been approved by the American Standards Association and published by the American Society of Mechanical Engineers. It establishes a new thread series that will simplify the design of space-age instruments, as well as watches and other more down-to-earth miniature mechanisms. The new publication establishes fourteen standard screw thread sizes, with a standard design that covers all of them.

Screws covered by this standard are so tiny that 75,000 of the smallest would fit in a thimble. The threads on these screws are invisible to the naked eye. The diameters of the screws range from 0.01 to 0.06 inch.

This publication is available at $1.50 a copy from the American Standards Association, 70 E. 45th St., New York 17, N. Y., or from the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

# HIGH-SPEED AUTOMATIC RIVETING OF CONVAIR JET AIRLINER COMPONENTS

**A. E. HILL, Works Manager**
**Convair, Plant 1, San Diego, Calif.**
**Convair Division of General Dynamics Corporation**

AMONG the highly productive machines that have gone into manufacturing lines at Convair (San Diego) Division of General Dynamics Corporation, for fabricating components for the 880 and 600 jet airliners, are completely automatic riveting machines that actually perform seven different operations.

These machines clamp a stringer to aluminum-alloy skin panels at a pressure of 500 psi—the necessary pressure for accomplishing a successful Scotchweld bond. They drill and countersink the multitude of holes in which rivets will be inserted. Actually, there are as many as 3300 holes of 1/4-inch diameter on one panel. Rivets of three different lengths are required because the skin panel is tapered. The machine selects the proper length of rivet to suit the cross-section thickness at each location along the length of the panel. After each rivet has been fed into place, it is headed with a squeezing force rather than a vibrating action. Up to 15,000 pounds of pressure are applied in heading.

After the rivet has been headed, its top is shaved flush with the skin surface by a short horizontal broach. Next, the assembly is unclamped and an air blast blows chips away from the work area. The skin-and-stringer panel is then moved into the next riveting position. These seven operations are automatically repeated until the entire assembly has been riveted.

There are four machines of this type in the plant. They were developed to Convair specifications by the Nuclear Products-Erco Division of ACF Industries, Inc., Riverdale, Md., and are designed to do a complete job on aircraft wing and fuselage skin-and-stringer panels at high

Fig. 1. One of four Erco riveting machines which automatically performs seven steps in producing components for Convair 880 and 600 jet airliners.



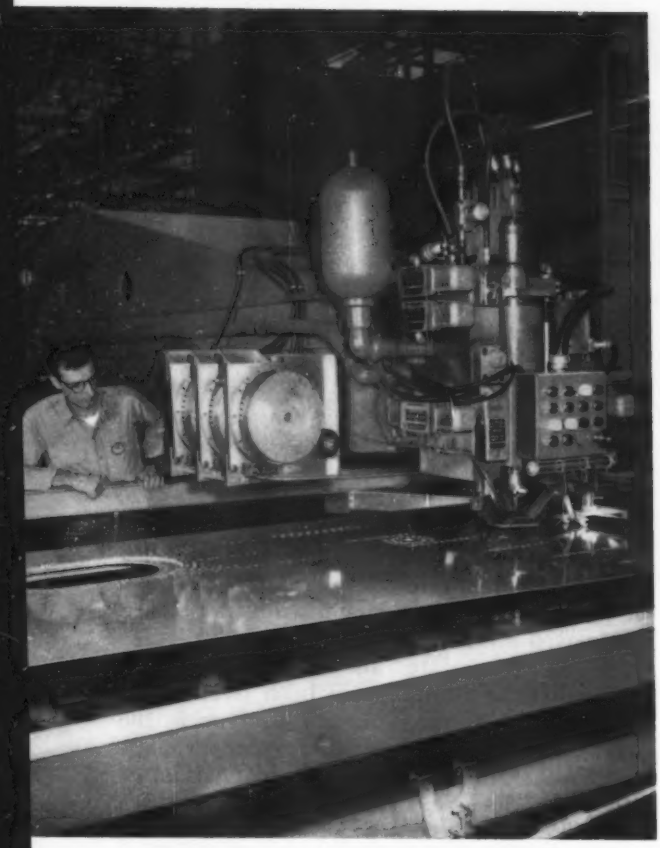


**Fig. 2. Three hoppers on left-hand side of riveting head feed rivets of different lengths to suit the changing thickness of the members being assembled.**

speed and without the necessity of finishing operations. The total cost of the four machines with tooling and controls was $442,896.

A general view of one of these machines is presented in Fig. 1. There is a close-up view in Fig. 2 which shows the rivet-feeding magazines or hoppers on the left-hand side of the riveting head. Fig. 3 shows a close-up view of the tools that perform the drilling, countersinking, heading, and broaching steps of the operations.

The combination drill and countersink is seen at *A*, the heading tool at *B*, and the broach-actuating arm at *C*. The chute that brings the rivets into place is seen at *D*, while the small tube through which the air blast is directed on the tools and work is indicated at *F*. Clamp *E* descends on the work with each combination of operations.

These steps of the operation overlap in time sequence. For example, broaching of the rivet head flush with the skin is accomplished with no additional time required. The machine has a capability of driving over twenty rivets per minute. Actual production time is dependent to some extent on the rivet spacing and the combined thickness of the individual assembly. With a

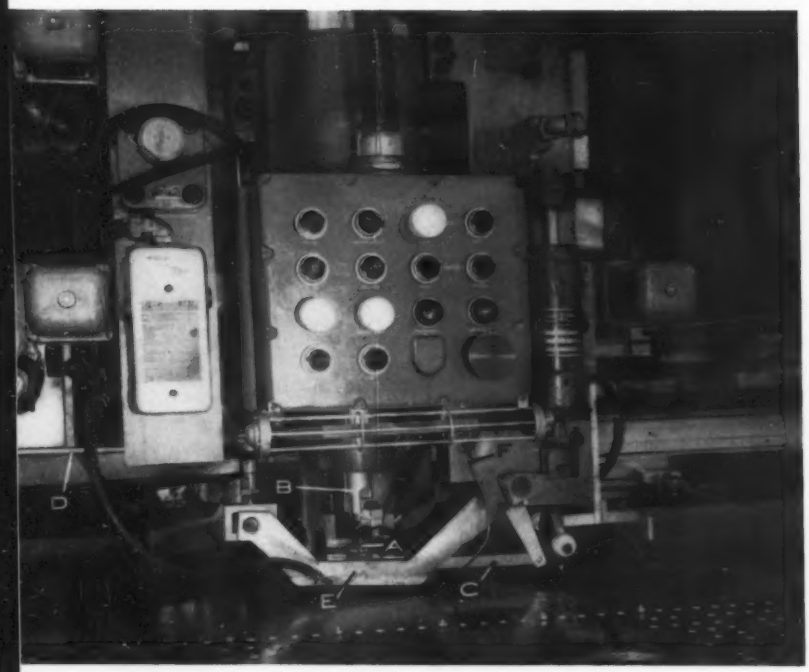



**Fig. 3. Close-up view of riveting head, showing the tools which perform the various steps such as drilling and countersinking, rivet-heading, and head broaching.**

rivet spacing of 1 inch center-to-center and a work thickness of 3/8 inch as on wing skins and stringers, the machine operates at a rate of twelve rivets per minute.

Rivet locations are controlled by a template at the front of the machine. A sensing device in the control mechanism of the lower head selects rivets of proper length as the operation proceeds.

Skin-and-stringer panels up to 12 feet wide and 25 feet in length can be accommodated. The 120-inch throat of the machine column enables the riveting of skins with extreme curvature.

The Convair-San Diego Tooling Department designed and built the work-tables, the individual holding fixtures for each skin panel, and the control console for the riveters. The panels are assembled in stationary fixtures where Scotchweld adhesive film also is applied. Stringers are then attached in place with tack rivets. Next, the panels are placed in the fixtures on the work-table.

A special modified Straylor rivet is used on the 880 and 600 wings to insure a metal-to-metal fuel-tight seal. This is necessary because these wings serve as fuel tanks in addition to their normal function.

These integral fuel tanks, formed by the structural spars, bulkheads, and skin-and-stringer panels, are made maintenance-free and leakproof through the Scotchweld adhesive bonding process developed at Convair. This process involves coating all wing parts with Scotchweld prime both as a part of the bonding process and as an anti-corrosion measure, covering the surfaces to be joined with Scotchweld adhesive film before riveting, and finally curing the entire half-wing in a giant electric oven.

The Scotchweld process was developed and first used on the F-102A all-weather, delta-wing interceptor. In more than four years of use, no leaks have developed in these supersonic planes.

All exposed rivet heads on the wings are shaved or broached because the 880 and 600 jet airliners operate in the high subsonic area and therefore have highly critical requirements for aerodynamic smoothness. The Erco riveting machines also have the capability of utilizing headless or slug rivets, although these rivets are not presently used on commercial jet airlines.

The riveting machines employ hydraulic, pneumatic, and electrical systems. The hydraulic system operates at a maximum of 1800 psi. It is powered by a 25-hp motor that drives a pump at 1800 rpm that delivers 27 gallons of hydraulic fluid per minute. The pneumatic system operates under a factory air pressure of 90 to 100 psi. The electrical system control and actuating circuits are run on 115-volt alternating current provided by a transformer.

## Do's and Don'ts About Grinding-Wheel Safety

Grinding wheels are safe when *used,* not *abused.* The Carborundum Company, Niagara Falls, N. Y., lists these ten "Do's and Don'ts" to help the grinding machine operator work safely:

1. DO always handle and store wheels in a careful manner.
2. DO visually inspect all wheels before mounting for possible damage in transit.
3. DO check maximum operation speed established for wheel against machine speed.
4. DO check mounting flanges for equal and correct diameter. (Should be at least one-third of the wheel, and be relieved around the hole.)
5. DO use mounting blotters. These are supplied with the wheels.
6. DO be sure work-rest is properly adjusted. (Center of wheel or above; no more than 1/8 inch away from wheel.)
7. DO always use a guard covering at least one-half of the grinding wheel.
8. DO allow newly mounted wheels to run at operating speed with guard in place for at least one minute before grinding.
9. DO always wear safety glasses or some type of eye protection when grinding.
10. DO turn off coolant before stopping a wheel to avoid creating out-of-balance condition.

1. DON'T use a wheel that has been dropped.
2. DON'T force a wheel onto the machine or alter the size of the mounting hole.
3. DON'T ever exceed maximum operating speed established for the wheel.
4. DON'T use mounting flanges on which the bearing surfaces are not clean and flat.
5. DON'T tighten the mounting nut more than is necessary.
6. DON'T grind on the side of the wheel unless wheel and equipment are specifically designed for that purpose.
7. DON'T start the machine until the wheel guard is in place.
8. DON'T jam work into the wheel.
9. DON'T stand directly in front of a grinding wheel whenever a grinder is started.
10. DON'T grind material for which the wheel is not designed.

A 12- by 12-inch wall chart of these "Do's and Don'ts" is available from Carborundum. Write to:

Advertising Distribution Section, Building W-5,
The Carborundum Company,
Walmore Road, Niagara Falls, N. Y.

# Appraisal of Soviet Mechanization and Automation

JOSEPH A. GWYER, Research Analyst, Library of Congress, Washington, D. C.

LATE LAST YEAR Nikita Khrushchev told the world that Russia by 1970 will be the world's No. 1 industrial power—outproducing the United States in per capita output and in actual goods. An idle boast? Possibly. But we in the United States must realize that our very survival, and that of the entire Free World, depends upon how well we can counter Soviet Russia's increasingly vigorous economic offensive. If the Russians can speed up automation and at the same time cut production costs, they may expand their export program to the point where it will mean political domination of the world's underdeveloped areas.

Khrushchev is placing heavy emphasis on over-all mechanization and automation of manufacturing as a means of attaining the world's highest per capita production. But just how far along is the Soviet Union toward this goal? How much of Russia's vaunted all-out industrial drive is fiction? How much is fact? How fast is Russia gaining on us?

For the answers one must go to the Russians themselves, to their technical magazines and literature. From these sources, this article will attempt to survey (1) the history and present status of automation in the Soviet automobile and bearing industries, (2) the over-all scope of automation in Russia, (3) critical deficiencies in Russia's automation program, and (4) economic implications of the Soviet drive for industrial supremacy.

### *Early Soviet Mechanization*

Automation had its beginnings in the Soviet Union in 1940, when a line was installed at the Stalingrad Tractor Plant. Its functions were to bore, machine, and trim tractor hubs, and perform several other operations. This line consisted of four metal-cutting machine tools and a specially designed forge press. The machines were linked by a conveyor and equipped with loading devices. A single toolsetter, who replaced seven preautomation workers, attended the line.

During that same year, the first automatic line for grinding rollers for tapered roller bearings was operated at the No. 1 State Bearing Plant in Moscow. It was made up of six centerless grinders and had pipes that served as conveyors for the tapered rollers. The line is still functioning, but at another Russian bearing plant. In addition, the No. 1 Bearing Plant began grinding the faces of ball-bearing races on an automated line, which consisted of three vertical-spindle grinding machines. The machines were linked by conveyors equipped with demagnetizing devices. Each grinder had controls to compensate for abrasive wear.

Concurrently, the Russians installed an automatic line for grinding piston rods in the Gorky Automobile Plant—six centerless grinding machines linked with a conveyor. A similar line, consisting of only two machines, was put into operation at the Moscow Automobile Plant.

Other automatic lines installed in 1940 included one at the No. 1 State Bearing Plant for simultaneous turning of twelve different-size bearing races on locally available multiple-spindle automatic lathes and two at the Stalingrad Tractor Plant for machining suspension arms. Each of the latter setups consisted of four automated engine lathes and one special horizontal boring machine.

In contrast to the aforementioned lines, all of which were built around conventional equipment, were those employing special machines. These were developed between 1948 and 1953. For instance, the Kharkov Tractor Plant's automatic transfer equipment for machining tractor cylinder blocks consisted of twenty individual machine tools and required only five operators.

Similar automatic transfer machines were placed in operation in the Stalingrad and Minsk

tractor plants and in the Serp i Molot plant in Saratov. The ZIL Automobile Plant, Moscow, introduced four automatic transfer machines in 1946, three more in 1950, and one in 1956. Other such machines went into operation at the Moscow Plant for Small-Displacement Automobiles; the Gorky, Yaroslavl, and Kutaisi automobile plants; and the Minsk Tractor Plant. Modern automatic production lines were also introduced at the Kuibyshev valve plant, the Novorossisk piston-rod plant, and the Odessa "October Revolution" piston-ring plant.

### *Specialized Facilities Lacking*

Some ninety-four automatic transfer machines were designed in Russia during the Fourth and Fifth Five-Year Plans, but only seventy-eight of them were actually built. While these machines were highly efficient, the Russians found the cost of their manufacture very high and the lead time required for designing and producing them excessive. One reason why automatic transfer machines took so long to build and cost so much was that centralized production of automatic devices and specialized facilities for the job were lacking.

Even today, individual sections of transfer machines are made in many machine tool and instrument plants, instead of in just one or two, on a piece-to-piece basis. Equipment for one of the Moscow bearing plant's automatic lines was built by eighteen different machine tool and instrument-making facilities, all of them wholly unprepared for such a task. Assembly of automated-line components is generally done by the plant using the equipment, which added further to the delay in getting such equipment into operation.

According to official Soviet sources, the four automatic transfer machines placed in operation in 1946 at the ZIL Automobile Plant each cost 7.4 million rubles. Three others put into operation in 1950 cost 4.6 million rubles, and the latest one, introduced in 1956, also cost this much.

As of 1957, the ZIL plant had nine automatic transfer machines in operation. By 1965, this same plant is expected to have fifty such machines. Similarly, the MZMA plant, which has seven machines today, should have twenty-nine by 1965. And by 1960, the present ten automatic lines at the Gorky Automobile Plant will be increased to seventy. Cheliabinsk Tractor Plant today has no automatic lines, but will have at least five by next year. The Stalingrad Tractor Plant will introduce more than twenty automatic and semi-automatic lines.

The showcase of Russia's automation program is undoubtedly 1 GPZ (First State Bearing Plant) in Moscow. At the end of 1957, this plant had nine automatic lines. By 1965 it will have thirty-seven. This plant placed seven automatic lines in operation from 1951 to 1957, rebuilt 950 machine tools, and equipped 650 machine tools with automatic attachments. The 1 GPZ plant purportedly claims to have the first fully automated ball-bearing shop.

In the last seven years, output of bearings at 1 GPZ has doubled, without new equipment being added, even though most machine tools in the plant are from twenty to twenty-five years old. Specifically, thirty-three four-spindle semi-automatic lathes more than twenty years old have been completely rebuilt at 1 GPZ. This "modernization" consisted of replacing special transporters, and replacing the bearings. Similar modernization was done on fifty-seven multiple-spindle semi-automatic lathes.

### *Mechanization of Materials Handling Being Emphasized*

Russia's technical progress is most apparent today in the expanded use of machinery and mechanical processes to take the place of human labor. One reason is that in the period 1959-1965, and perhaps for many years after that, Russia will not have as large a labor pool as in the past. This will be so because Russia's birth rate was extremely low during World War II, while infant mortality during the same period was high, and staggering manpower losses also occurred.

For these reasons, most Russian mechanization is designed to eliminate manual labor in such operations as lifting, conveying, and material storage. Of these, conveyor and material storage operations are the most critical, because they account for 25 to 30 per cent of the total labor expended in manufacturing.

According to Russia's May 5, 1954, census, the ferrous metallurgy industry had 34.6 per cent of its workers doing manual labor; coal mining had 44.1 per cent; machinery manufacturing, 48 per cent; lumbering, 67.8 per cent; and building, 69 per cent. More than 55 per cent of 7.2 million workers employed in fifteen key Russian industries were doing manual work.

Even Russia's automobile manufacturing industry, generally considered to be one of that country's most mechanized, suffers from inadequate mechanization of primary processes, and from complete absence of mechanization of supporting operations.

For example, in the manufacture of the MAZ-200 automobile at Minsk 44.3 per cent of the work is done manually. Production of the ZIS-585 dump truck at Mytischi Machinery Mfg. Plant is 47.8 per cent manual. In such heavy machinery manufacturing plants as those at Kramatorsk, Uralmash, Yuzhuralmash, and Irkutsk, 50 to 70

per cent of all workers are engaged in manual labor.

In Soviet instrument plants, where mechanization is supposedly at its height, manual workers make up from 35 to 40 per cent of the labor force, and in some cases, 60 per cent.

In many Soviet plants which produce complex machines and equipment, the movement of heavy parts, unloading of raw materials, and other supporting operations are carried out haphazardly, mostly by hand, and often by skilled labor diverted from primary duties.

Such partial mechanization, Soviet engineers have found, not only creates scheduling difficulties and fails to solve production problems but complicates such difficulties out of all proportion to the benefits achieved.

Lack of mechanization of supporting operations has almost always affected primary production, often causing interruptions, inadequate handling of equipment, and crash programs to catch up with the mounting backlogs. This is usually followed by extensive breakdowns of equipment and production schedules.

Automation cannot very well be introduced into a plant that employs primitive processes and out-of-date machines, and this is where Russia's automatization program falls down badly. State commissions and ministries have been set up to alleviate this problem—to draw up annual and long-range plans for replacing obsolete machines.

Very little replacement has been accomplished in the last two or three decades, mainly because the responsible agencies are still convinced that "Ne umeniyem a chislom" (Things are accomplished "not by skill but by numbers" in the Soviet Union). There is, however, a group within the Soviet Union that would rather see less propaganda about Russia's industrial accomplishments and more truth about its deficiencies.

### *Present Status of Automation Not Impressive*

Just what *can* be seen in Russia in the way of automation today? Not too much. The USSR is barely entering into the automation stage. Take this fact: Russia's pool of metal-cutting machine tools in 1957 consisted of about 1.84 million units, but there were altogether only about 100 automatic transfer machines in operation. Conventional production lines are more numerous but to quote Strumilin, dean of Soviet economists, "when one considers that manual labor is used along production lines to a large extent (more than 50 per cent of all operations along the production lines are performed by manual labor)," the beginning is unimpressive.

Gosplan USSR (State Planning Commission) estimates that from 1959 through 1965 the Soviet Union should introduce 1400 automatic lines, which require from 12,000 to 14,000 metal-cutting machine tools. But the plain fact is that Russia today does not have enough automatic and semi-automatic machine tools suitable for automated lines. A considerable portion of the machine tools made in the USSR today consists of general-purpose units, only a few of which can be equipped with quick setup, clamping, and measuring attachments.

Back in 1955 there were fewer than 50,000 automatic and semi-automatic machine tools in the USSR, and the Soviet machine tool industry cannot turn out such equipment in large quantities even today. In fact, most Russian machine tool plants are building unduly large numbers of lathes rather than automated equipment.

Engine lathes comprise more than 30 per cent of Soviet machine tool stocks, and they make up about 30 per cent of annual machine tool output. Turret lathe production, on the other hand, is admittedly inadequate (only 2825 units in 1955 and about 2977 in 1957). The inability to satisfy broaching machine needs (only 307 units produced in 1955 and about 364 units in 1957) prompted Russia to seek out Western producers of such equipment.

The growth of the Russian instrument industry is partly retarded by an insufficient output of grinding machines (3959 units in 1955, 3960 units in 1957). And it is interesting to note that while actual production of grinding machines did not vary in quantity during the 1951-1955 period, their percentage in relation to the total machine tool output dropped from 5.68 per cent in 1951 to 3.38 per cent in 1955.

This same critical situation exists in gear-cutting machines. Until 1950 the Soviet Union relied to a large extent on imported bevel and spiral gear generators. Since then, ENIMS (Experimental Scientific Institute for Metal-Cutting Machine Tools), despite strenuous efforts, has been unable to meet domestic demand.

A survey of production quotas for various types of machine tools, made in mid-1958, shows that Russia's six-month plan for production of highly complex units was not met by the machine tool industry. Quotas for outmoded, comparatively unproductive machine tools (lathes in particular) were surpassed by some 4500 units.

### *Production of Controls for Automation is Lagging*

And if the machine tool production situation in Russia appears to be critical, the state of affairs in the instrument and electronics industries, which must provide controls for automation, is even more critical.

According to papers delivered in 1956 at a Russian automation conference, the USSR lags far behind the West in manufacture of analog devices, mainly because its radio and electronics industry has failed to supply the necessary high-grade parts and components. One conference paper pointed out that Soviet industry has not yet sufficiently coordinated the findings of research organizations investigating the use of semiconductors and, consequently, there is a lag in their application.

Even the Central Committee of the Communist Party recognized these shortcomings and in 1956 resolved to adopt measures "for rapid development of industries charged with the responsibility for providing necessary automatization equipment." These resolutions envisaged construction of thirty-nine new instrument plants and modernization of seventeen more between 1956 and 1960. But despite the urgency of the program, progress has been slow and only 20 per cent of the program was accomplished in 1956-1957. As of 1958, many instrument plants were still without testing facilities, adequate laboratories, and design bureaus.

Automatic equipment cannot be produced until qualified men are available to do the job, and even after such equipment is produced, there is still the problem of specialized labor to operate and service it.

Many factors today impede the development of automation in Russia. They are:

Too much obsolete equipment not suitable for automation;

Too few automation specialists;

Poor organization of scientific research in the fields of automation and manufacturing processes;

An insufficiently developed instrument industry;

Lack of proved methods for design and construction of automated equipment.

Confirmation of the lack of automation specialists can be found in an article published in the USSR in 1958 in which the author states that there is not a single school of higher education in the Soviet Union with facilities for training automation specialists. According to Mr. Strumilin, the Soviet boast that in 1955 it surpassed the United States in the number of engineers (Russia, 586,000; United States, 550,000) is meaningless.

For instance, Soviet engineers learned to design steam locomotives well, but long experience with them made the engineers so hidebound in their thinking that it was virtually impossible to get them to make the transition from steam to electric-diesel locomotives. Automation requires modern education, training programs, and special schools. These Russia still does not have.

The theory of automation is inadequate in Russia today, too, even though Russia considers herself on a par with the United States in the theory of automatic control. But in terms of level and volume of automation of industry, the USSR is admittedly "substantially well behind."

Soviet economists and planners agree that overall mechanization and automation of Russian industry would mean (1) increased productivity of equipment without increasing its size, (2) reduced volume of support equipment, (3) better plant layout and more production per square foot of manufacturing space, and (4) reduced equipment costs because of cutbacks in size and weight of machines.

That is the principle upon which economists and planners agree, but there is still disagreement on the effectiveness of automation. Even as late as 1958, Soviet economists were not sure that automation would be profitable in a socialist state. I. F. Tevosyan, ex-vice-chairman of the Council of Ministers, said during the Twentieth Congress of the Communist Party, "Soviet economic and planning agencies in solving industrial economic problems were least of all concerned with the per-unit cost of production."

The USSR for the last thirty years, another official claims, has followed the same concepts of applied economics to the point where they have become dogma—creating bureaucracy and irresponsibility, both of which hinder introduction of new and progressive economic methods. Automation of production processes in the Soviet Union, still another official has said, has been made "very difficult" because of an almost complete absence of data on the very plants to be automated, and because of the difficulties encountered in trying to conduct experimental automation studies under normal production conditions.

### *USSR Spending Comparatively Little for Automation*

One compelling handicap appears to be the existence of plants equipped with expensive machinery that is not adaptable to automation. Here, Russia is reluctant to scrap such existing machinery in favor of automatic or semi-automatic machines. Consequently, even in those industries in which automation does exist, it is at best partial, confined mostly to individual pieces of equipment. This is exemplified by the comparative amount of money spent for automated equipment in Russia (2 to 4 per cent of total capital goods investment) versus the United States (15 to 25 per cent).

The ratio of automation to total capital spend-

ing is higher in Russia's automotive and tractor industries, but it is still insignificant compared with that in the United States. If this is true, and these facts about the USSR's lag behind the United States in automation come from the Russians themselves, why is the Soviet drive for automation getting so much publicity?

For one thing, Soviet propaganda is designed to make the Free World believe in Russia's industrial invincibility and, aided by those who accept such propaganda at its face value, has succeeded in creating this erroneous impression.

But the USSR's spectacular crash programs and technological achievements have been accomplished at the expense of all research and development not contributing directly to military effort. Such achievements lack depth, and there is little or nothing for the West to be alarmed about over Russia's nonmilitary production.

This is not wishful thinking. It is fact based on official statements from the Russians themselves—facts they can no longer hide, even from themselves. The continuous, unrelenting drive for quantity rather than quality has created material and technological bottlenecks which the Russians are finding difficult to break.

An example of how Russia is trying to deceive the West into believing that all is well on its industrial front was the USSR's exhibit at the Brussels Fair. To the untrained eye, the machine tools and instruments were impressive, especially with skillful narrative and baskets full of handouts to heighten the impression that the Soviet Union had as much or more, and as good if not better, machinery and equipment than the West. But the truth is that the very machines shown at Brussels were those in critical demand in the Soviet Union.

A recent visitor to the USSR, a labor leader, visiting a Soviet plant, found that most machine tools and other equipment were obsolete. Where, he asked, were all the modern machine tools that Russia claims to have? A Soviet worker, evidently unrehearsed, and with a perfectly straight face, replied, "Well, some of them are at the Moscow Fair, so the rest must be in Brussels." Perhaps this quip is farfetched, but when one considers the facts, this straight and simple reply echoes an element of truth.

What, then, *has* the Soviet Union achieved since 1955, when its all-out drive for automation began to be publicized? Some answers were uncovered by the findings of the All-Union Conference of Soviet Workers which was held at the Kremlin in May 1958:

> Despite such achievements as the Sputniks and atomic energy programs, Soviet industry still has serious shortcomings.
>
> Progress in automation has been slow in spite of the resolutions of the Twentieth Congress.
>
> Theoretical studies of automation are still inadequate.
>
> The number of available semi-automatic and automatic machine tools and automatic production lines in Russia is insufficient.
>
> Too many Russian technological processes still require a large amount of manual labor.
>
> Soviet industry still lacks a unified technical policy on the principal problems of automation.
>
> Mechanization of materials handling and storage is not extensive.
>
> There is a drift and disjointedness in Soviet instrument manufacture and a significant lag behind the West in the design of controls.
>
> Training of personnel in rudiments of automatization of manufacturing processes and in instrument-making is inadequate.
>
> Interchange of technical data on automation is poor.
>
> There is too long a lead time between an invention and putting it to practical use.

Some of these findings have been echoed by Khrushchev, who last November said that in order to attain the economic goals set forth in the Seven-Year Plan (1959-1965), Russia must expand production of modern machine tools, instruments, and other equipment for over-all mechanization and modernization of its industry.

This is quite an undertaking when one considers that in 1955 the Soviet per-capita physical output of capital equipment was only about 28 to 30 per cent of that of the United States.

Can the Soviet Union, then, attain these goals within the allotted seven years? It is this author's opinion that she will not—because progress toward full automation can only be achieved through uniform mechanization. Too, the USSR's progress will be slowed down by a lack of designers, prototype makers, production engineers, and other highly specialized personnel.

Consequently, it may take Russia fifteen to twenty years to do the job, even with a full complement of machines, instruments, and adequate training methods. This period could be shortened if the Soviet Union were to go beyond its own sphere of interest for direct and indirect help. There are some indications in the Soviet's East-West trade proposals that this is being done, particularly in the areas of machine tools and chemical processing—and even in Russia's paradoxical (in view of her boasted technological supremacy) desire to assimilate American technical and engineering knowledge.

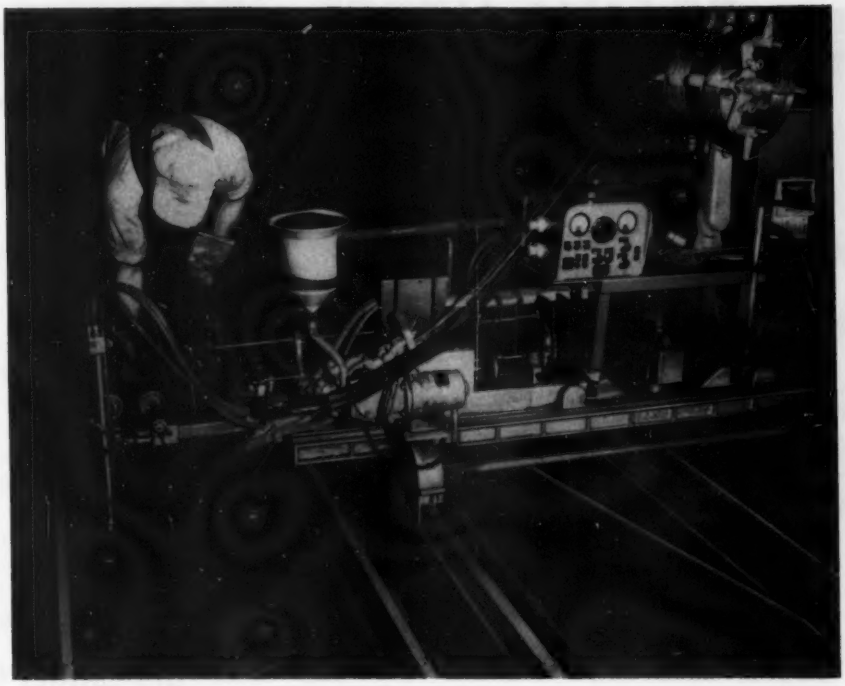


Fig. 1. A portion of the web, near the end of this I-beam, is removed by oxy-acetylene cutting to allow beam to clear the wheel truck. Both the cutting and welding machines are supported on a single carriage.

# Welding the Giant "Piggybacks"

G. C. SHIELDS
Linde Company, Kansas City, Mo.

"PIGGYBACK" SERVICE, combining the speed of long-distance rail travel and the convenience of door-to-door truck hauling, is a service now offered by many American railroads. When these operations were inaugurated, converted standard-size flat cars were the first piggyback haulers. It was discovered, however, that in most cases a standard flat car could handle only one trailer.

The Atchison, Topeka, and Santa Fe has improved the efficiency of its piggyback service by producing a specially designed car that can easily accommodate two 40-foot highway trailers. These rugged, welded flat cars, known as "88's" because of their 88-foot length, were built by the Santa Fe's Topeka, Kan., car shops to have a 57 1/2-ton capacity and a 38 1/2-ton center load limit.

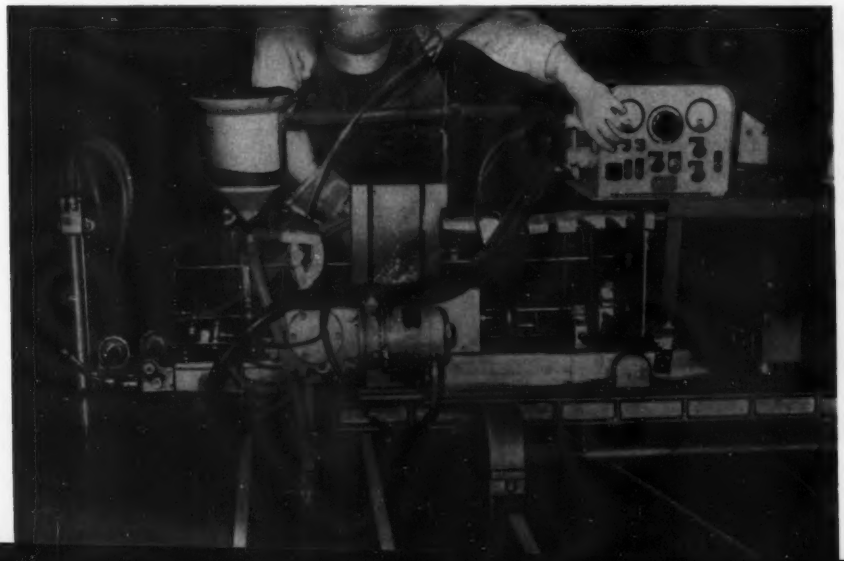


Fig. 2. This welding head is about to make a long, continuous weld. The dual-wire feed mechanism advances tandem electrodes into weld area. The operator has easy access to control unit while welding is in progress.

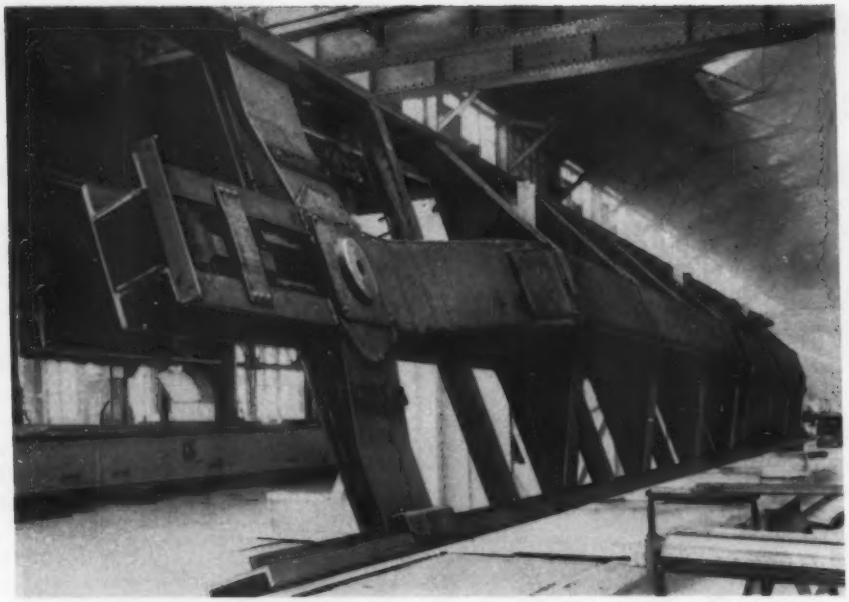


Fig. 3. Underframe of the "88" piggyback flat car. Box-like center sill is made from two 30-inch (132 pounds per foot) wide flange beams; the side sills from 12-inch (35 pounds per foot) channels.

As in all railroad cars, the main structural member of the piggyback car is its center sill. Subjected to many types of stresses, the center sills of these cars must support heavy loads. They are formed from two 30-inch (132 pounds per foot) wide flange (WF) beams, joined side by side by Linde Company's multiple-power Unionmelt welding process. Welding time is substantially reduced through the use of twin electrodes and special fixtures that enable the whole seam to be welded downhand.

Side sills for the cars are made of 12-inch (35 pounds per foot) steel channels. Top guide rails, constructed of 10-inch I-beams, are welded to the tops of the side sills. Cross-bearers, crossties, and bolster sections join the center and side sills, forming an all-welded, all-steel underframe.

An unusual feature of the welding setup is a double-purpose fixture (Fig. 1) that mounts one of Linde's Oxweld oxy-acetylene cutting torches and a complete Unionmelt welding machine. Use of this fixture eliminates excess handling of the heavy steel components and results in a saving of floor space.

When an operator wishes to change from cutting to welding he simply turns off the cutting torch and switches on the Unionmelt machine control. The welding machine, shown in use in Fig. 2, incorporates a dual-wire feed mechanism with two parallel electrodes in tandem. Two of these combination machines simplify production of the huge steel components that go into the giant piggyback flat cars. A completed underframe of one of these unusually large cars is illustrated in Fig. 3.

## Die Cavities Cast to Size

A casting method to produce dies having cavities cast to their finish dimensions has been successfully developed. The Manufacturing Methods Division of Air Materiel Command, Aeronautical Systems Center, announced that the work was performed by the Armour Research Laboratories of the Illinois Institute of Technology.

This process allows alloys which are difficult to machine but are capable of operating at 1600 degrees F. to be used to make finished dies for hot-forging operations without machining. High die-operating temperatures were proved advantageous for producing intricate shapes because the forged part was not chilled as severely as in normal practice.

The final engineering report reveals that the cast dies were operated at 1600 degrees F. to forge steel parts. The casting method of making dies was sought in order to produce forgings with long, thin projections, which are difficult to form since the hot-forged metal is rapidly chilled by a cold die.

Production of the cast dies required development of a moldable graphite mixture. This mold material was capable of being fired to 2000 degrees F. to free it of volatile matter. Dies cast in such molds were sound and had a 125-micro-inch surface finish. Use of the graphite mold also resulted in a chilled cast structure and a grain size approximately one-half that of castings produced in normal sand molds. Forgings produced in dies operated at 1600 degrees F. showed a marked increase in die filling.

# CUTTER-WHEEL TEETH MILLED WITH UNEVEN SPACING

**SAMUEL HERMAN, Shop Superintendent**
**Thomas C. Wilson, Inc., Long Island City, N. Y.**

BOILER and heat-exchanger tubes must be kept clean, not only to maintain designed output, but also to eliminate overheating, oxidation, pitting, and other forms of tube deterioration caused by accumulated scale. To accomplish this, a complete line of tube-cleaning equipment is manufactured by Thomas C. Wilson, Inc., in Long Island City, N. Y. Cutter wheels are used in this equipment to remove the internal deposits. When mounted in rotating cutter-heads, the wheels are thrown outward by centrifugal action and bite forcibly into the scale.

One problem with previous designs of cutter wheels was that the teeth on one wheel would "track" in the path made by the teeth of the preceding wheel. Tracking occurs when the teeth of each advancing wheel cut in the same location against the scale. As a result, grooves are cut but the deposits are not effectively removed. To combat this tendency, Wilson has developed a method for manufacturing nontracking cutter wheels on which the teeth are milled with uneven spacing.

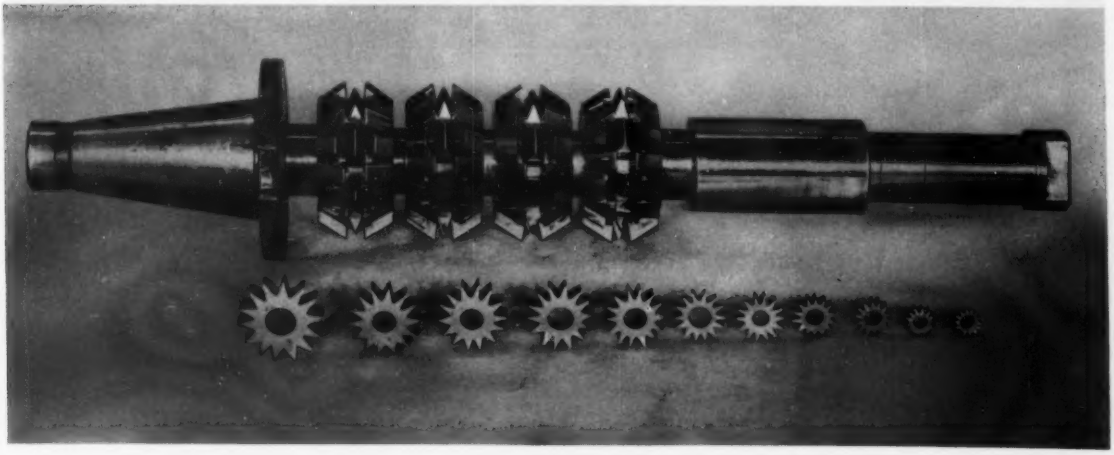
Nontracking wheels have fourteen teeth arranged in four groups of three and a single group of two. This is done by a set of three specially designed, interlocking, staggered-tooth milling cutters. Four of these cutter sets are shown mounted on a milling machine arbor in Fig. 1.

Each pass of a cutter set across an SAE 4140 leaded-steel blank produces three gashes having included angles of 62, 45, and 62 degrees, respectively. After each pass, the cutter wheels are indexed through an angle of 77 1/2 degrees and the process is repeated. On the final cut only two gashes are actually milled, inasmuch as the right-hand cutter in the set occupies the space already milled by the left-hand cutter during the first pass.

This operation produces the intentionally uneven spacing of two adjacent 62-degree tooth spaces, followed by a single 45-degree tooth space, again followed by two 62-degree tooth spaces. The pattern continues around the periphery of the cutter wheel, with the exception of the last group, which has a single 45-degree tooth space followed by a single 62-degree tooth space.

In actual production, cutter-wheel blanks are stacked on arbors that are then loaded on a quadruple indexing fixture, Fig. 2, bolted to the table of a Cincinnati milling machine. Four groups of

**Fig. 1. Four sets of three special cutters are ganged on this milling machine arbor. Some of the fifteen diameters of wheels produced by these same tools are lined up in front.**



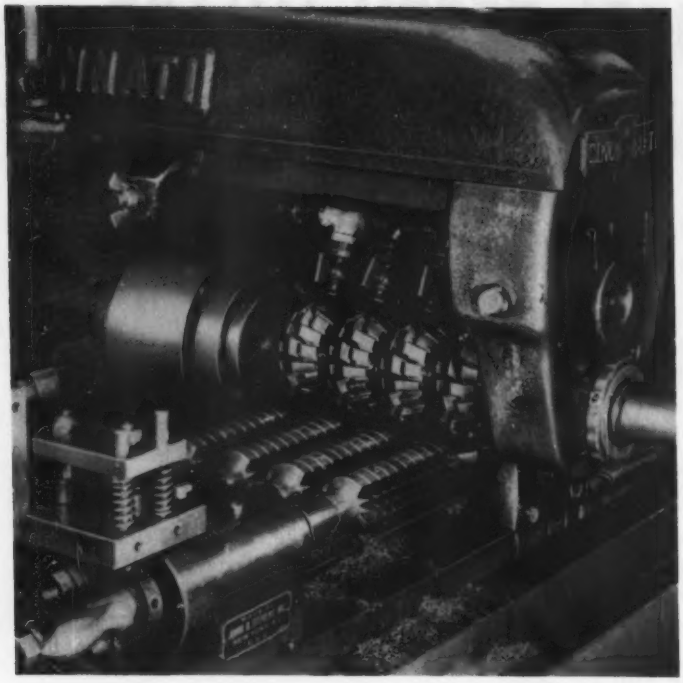


Fig. 2. (Left) Blanks are stacked on arbors, then loaded on this quadruple indexing fixture. Each pass of the milling cutters produces three gashes having included angles of 62, 45, and 62 degrees, respectively.

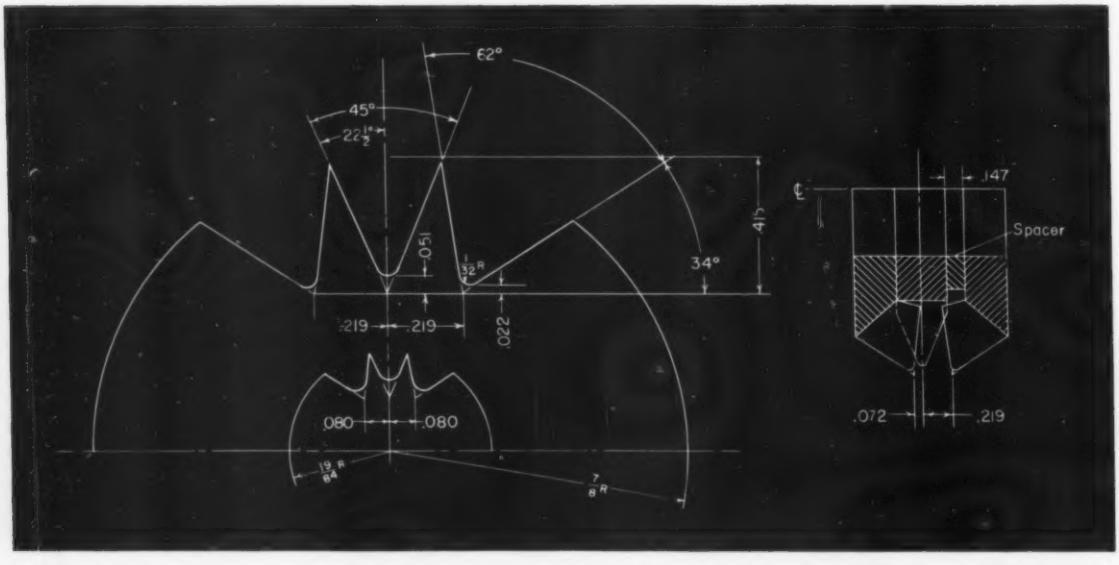
Fig. 3. (Below) One set of the special interlocking milling cutters handles the entire range of cutter wheels from the smallest, lower left, to the largest, upper left. Various tooth-space shapes are obtained by inserting spacers between the cutters (right).

milling cutters (a total of twelve individual cutters) produce these wheels in five passes.

There are forty-two sizes of nontracking cutter wheels being manufactured. They fall into fifteen standard diameters ranging from 19/32 inch to 1 3/4 inches. If solid form cutters were to be used, it would be necessary to have a different one for each of the fifteen diameters because the shape of the tooth spaces varies as the outside diameter changes.

The versatile interlocking, staggered-tooth milling cutters already described were designed to cover the entire range of diameters. This is accomplished by inserting a pair of spacers—a specific thickness for each diameter—between the cutters so as to vary the form of the milled gashes. Illustrated at the left in Fig. 3 are tooth specifications for the cutter wheels at the upper and lower limits of the diameter range. At the right is a section through the three milling cutters constituting a set.

With no spacers in place, as between the left-



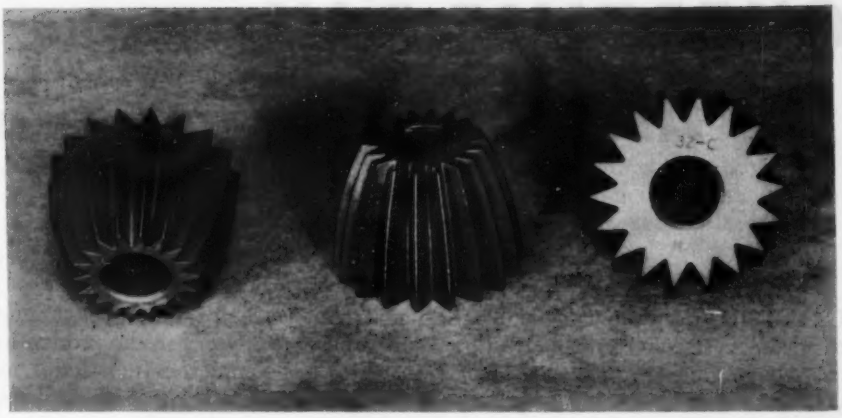


Fig. 4. Cone cutters precede the straight type cutter wheels in the head of the tube cleaner. Shown are three views of the crown type cone cutter having teeth cut along a radius.

hand and the center cutters, the point-to-point distance is 0.072 inch. To mill the smallest cutter wheel, spacers 0.008 inch thick would be inserted to bring the distance between points to the required minimum of 0.080 inch (lower left). On the other hand, 0.147-inch thick spacers would be necessary to obtain a point-to-point distance of 0.219 inch for the largest cutter wheel in the series (upper left). A representative group of cutter wheels produced by this same tooling can be seen in front of the milling machine arbor in Fig. 1. After machining, they are heat-treated to a hardness of 61 to 63 Rockwell C.

Cone cutters are mounted just ahead of the main cutter wheels. As the cutter-heads rotate, the cone, or tapered, cutters prevent the formation of sharp shoulders in the scale deposits, thus facilitating progress of the cutter-head through the tube.

One variation of the cone cutter is called the crown cone cutter. This type has eighteen teeth, obtained with a 60-degree angular milling cutter in eighteen passes 20 degrees apart. For the reason that the blank is not a true cone, the teeth of the milling cutter must follow a curved path so as to produce a uniform crest along a 3-inch radius. Three views of the crown type cone cutter are shown in Fig. 4.

In production, three blanks are slipped onto the arbors of a Brown & Sharpe triple indexing head. The indexing head is mounted on a cam-operated, pivoting auxiliary table that is bolted to the standard work-table of a Hendey milling machine. As the blanks are advanced into a gang of three cutters the table lowers, causing the blanks to follow an arced path while they are being machined.

The entire operating cycle is automatic except for the loading of the three blanks and the unloading of the finished parts. A combination of pneumatically and hydraulically operated cylinders is used to advance and retract the milling machine table as well as to index the three work-spindles. An air cylinder rapidly advances the work-table until the cone blanks are within 1/16 inch of the rotating milling cutters. At this point the motion changes to a slow, controlled infeed due to the action of a tandem-mounted hydraulic cylinder.

When the cut has been completed and the table has returned to its original position, a micro switch is tripped. This actuates an air cylinder behind the work-head which functions through a ratchet and pawl arrangement, causing each spindle to index precisely 20 degrees. Another micro switch is then tripped to start the cycle for the second cut. This procedure is repeated for the eighteen cuts required to complete the crown cone cutter. During the eighteenth indexing movement, a pin on the ratchet wheel strikes still another micro switch which opens the circuit to end the cycle.

* * *

## Liquid Pressure Nitriding

Now undergoing final tests in the laboratories of A. F. Holden Co., Detroit, is a new, time-cutting method for putting an extremely hard case, resistant to spalling and high temperatures, on aircraft structures and other nitrided-steel components. Referred to by the company as "liquid pressure nitriding," the process consists of immersing the steel part in molten salt into which anhydrous ammonia is passed under a pressure of 15 psi at a flow rate of 20 to 40 cubic feet per hour.

From eight to sixteen hours in processing time are saved compared to conventional dry or retort nitriding. Other advantages: Distortion is held to a minimum, and the "white" layer resulting from exhausted ammonia gases is thus eliminated.

# OVERTIME PAY... Are you figuring it correctly?

ROBLEY D. STEVENS, Management Consultant

CAN YOU, right now, account for your plant overtime costs? Do you know how much these costs have gone up in the past year? In fact, do you know *exactly* what your plant overtime costs are? If not, you may be paying too much overtime, and in that case, creating a heavy drag on your plant profits.

Employers engaged in the manufacture of metal products will discover in auditing their payrolls that both overpayments and underpayments in compensating workers can be a real source of grievance—and even of unnecessary government investigation. And yet, your plant may be paying a larger overtime bill than is necessary, because of an incorrect method of computation.

Employes are permitted to work any number of hours weekly so long as they are paid overtime. In an exempt status are those who hold executive or administrative posts, as well as professional personnel. Under the revised salary tests of the Fair Labor Standards Act (effective February 2, 1959) an executive employe, to be exempt, must be paid at least $80 a week instead of the $55 formerly required; and an administrative or professional employe, at least $95 a week instead of $75. In addition, a special proviso for employes qualifying for the exemption under shortened-duty tests is increased from $100 to $125 a week, and is applicable everywhere.

Wage-hour regulations do not require employers engaged in the manufacture of metal products to pay these salaries to persons doing executive, administrative, or professional work. The new salary tests are for exemption purposes only. If an employe who is covered by the Act does not meet the salary tests as well as the duties and responsibilities tests, he does not qualify for the exemption. In such a case, the employer may of course continue to pay the employe on the basis of a salary, but the Act's minimum wage and overtime pay requirements must be met, unless some other statutory exemption applies.

The Act requires payment of a minimum wage of $1 an hour and at least one and one-half times the employe's regular rate of pay for all hours worked beyond forty in a work-week to non-exempt employes engaged in interstate commerce or in the production of goods for interstate commerce. Included is any closely related process or occupation directly essential to such production. A work-week is considered to be a regularly recurring period of 168 hours—seven consecutive twenty-four hour periods—and need not conform to the calendar week.

This very moment is a good time for the company accountant to check on overtime pay practices—not later on, when an inspector may audit the payroll books and claim that additional pay may be due the employes. The following specific information may prove helpful in calculating the overtime.

**Hourly rate.** If an employe's pay is based solely on a single hourly rate, the hourly rate is his regular rate. For his overtime work he should be paid, in addition to his straight-time earnings, a sum which is simply determined by multiplying one-half the hourly rate by the number of hours worked beyond forty in the work-week.

**Pieceworker.** If an employe works on a piece-rate basis, the regular hourly rate of pay is computed by totaling his weekly earnings from such piece rates and all other sources, except statutory exclusions. This sum should then be divided by the number of hours worked in the work-week for which such compensation was paid, to yield the pieceworker's regular rate for that week. So, for his overtime work he should be entitled to, in addition to his total weekly earnings, a sum equivalent to one-half this rate of pay multiplied by the number of hours worked in excess of forty. In short, only additional half-time pay should be required in such cases, since the employe has already received straight-time compensation at piece rates for all hours worked.

**Day and job rate.** If an employe gets a flat sum for a day's work for doing a particular job, without regard to the number of hours worked in the day or at the job, and if he receives no other form of compensation for services, his regular rate should be determined by totaling all the earnings received at such day or job rates in a work-week and then dividing this figure by the number of hours actually worked. He is entitled

to extra half-time pay at this rate for all hours worked beyond forty.

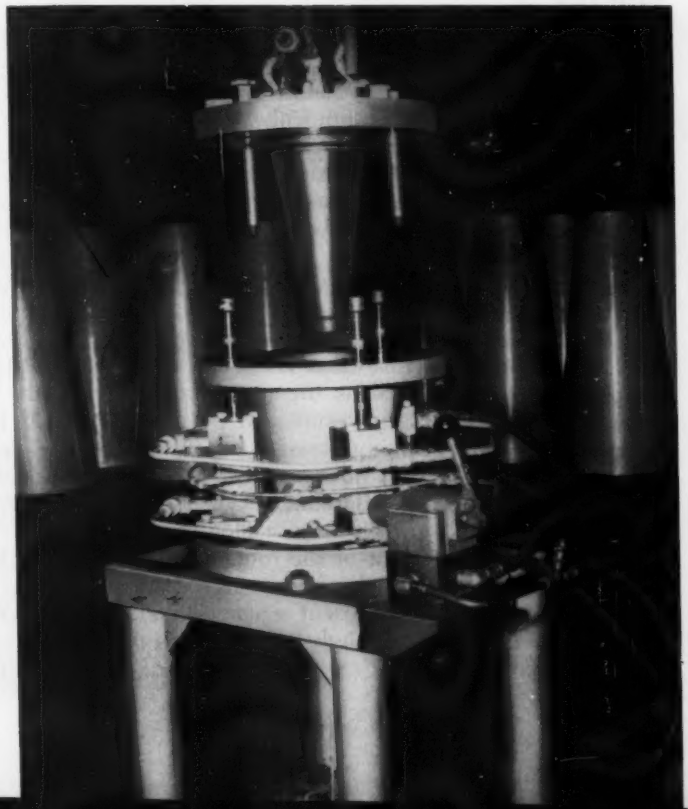
**Employe working at two rates.** If an employe in a single work-week is engaged in two or more activities for which different basic hourly rates of not less than $1 an hour have been established, his regular rate for that week is the weighted average of such rates. His total earnings (except for statutory exclusions) from all such rates should then be divided by the total number of hours worked at all jobs.

**Salaried employe—general.** For an employe on a weekly salary basis, his regular hourly rate of pay, on which time and a half should be paid, is simply computed by dividing his salary by the number of hours which his salary is intended to cover.

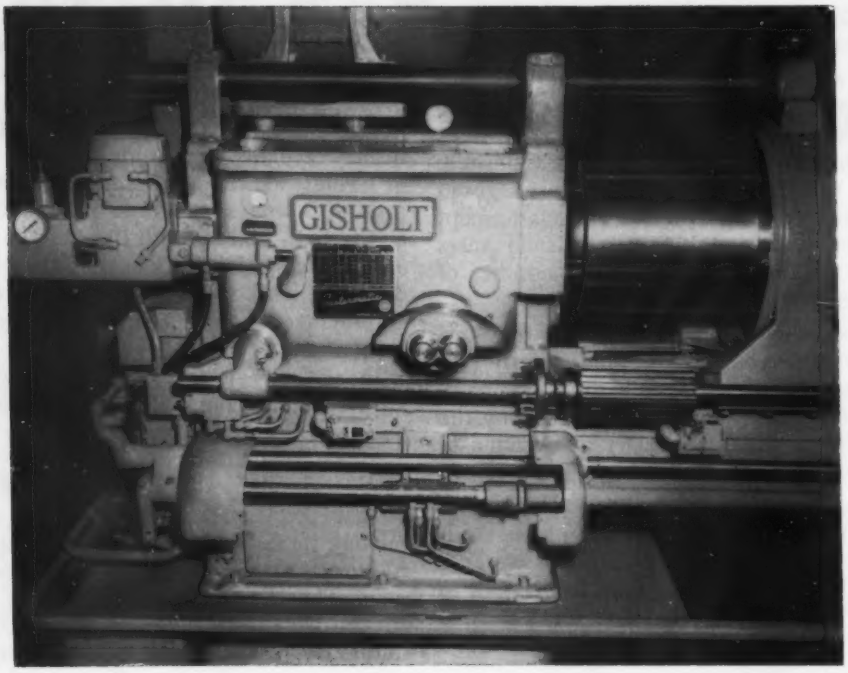
**Salaried employe—irregular hours.** For an employe earning $66 a week, with the understanding that his salary is to cover all hours worked, and whose hours of work fluctuate from week to week, obviously the regular rate of pay will vary from week to week and will be the average hourly rate each week.

**Excluded pay.** The following types of payments are not considered to be a part of the "regular rate" in computing overtime: Sums paid as gifts for Christmas or other special occasions; payments for unworked time due to vacations, holidays, illnesses, or the failure of the employer to provide sufficient work; payments determined at the discretion of the employer and not made by any prior contract or promise leading the employe to expect such money; contributions to pension, retirement, life, or accident and health insurance plans; premiums for work above daily or weekly standards; premiums for work on Saturdays, Sundays, holidays, regular days of rest, or the sixth and seventh days of the work-week; and premiums for work outside the regular workday and work-week and not as a result of an employment contract or collective-bargaining agreement.

In virtually every plant, the payroll is the largest single component of the cost of doing business. Records on overtime payments become vital if intelligent decisions are to be made about production and selling policies. Workers should be paid accurate amounts through orderly disbursing procedures and this requires accounting routines tailored to the particular needs of the plant. Payrolls for salaried employes should usually be kept separate since the calculations and frequency of payment make the procedural requirements simpler than those for hourly workers, but the general techniques need be little different. Charges are usually made to plant overhead, selling, or administrative-cost accounts, but the credits for the various classifications of liabilities are generally made to the same accounts as those employed for the plant payrolls.



**Forward nose cones for the Nike-Hercules are bulge-formed to an ogival shape at Douglas Aircraft's Charlotte (N. C.) Division. The parts for the surface-to-air missile are first blanked from sheets, then rolled into cones and seam welded. Female die has cavity of desired shape. Male die simply reduces air volume required, does not contact work. Bulging pressure is from 400 to 500 psi.**




# Power-Operated Chucks, Mandrels, and Collets

HARRY L. STEWART

THE USE of power-operated chucks, mandrels, and collets for supporting work on revolving spindles has a number of advantages. Most of the devices, being air- or hydraulic-operated, tie in well with automated equipment. As a safety feature, they can be interlocked with other motions of the machine. They can be integrated with air or hydraulic (as the case may be) work loading and unloading mechanisms, further automating an operation.

Another feature is that uniform holding pressures are always obtained. There is no need to rely on the operator's strength in gripping the work. This eliminates distortion from excessive gripping pressure, as well as the possibility of losing the work because of insufficient pressure. Obtaining the right gripping pressure becomes a mere matter of adjusting a valve.

Again, operator fatigue is reduced. Wrestling with a large wrench gives way to a flick of the wrist or a slight movement of the foot. Another advantage of the power chuck is that reserve movement of the jaws is present when needed. Often when chucking a rough cast or forged piece, one jaw may grip on an imperfection. Should cutting pressure break down the imperfection, slippage might result were it not for the reserve movement of the jaws, which keeps them constantly against the work.

### *Chucks*

Undoubtedly the largest number of power-operated holding devices used on revolving spindles are chucks. Movement of the chuck jaws is accomplished in several ways: by a lever behind each jaw, by a central sliding wedge, or by a bayonet slot and pin arrangement.

One lever design is shown in Fig. 1. Here, as pressure is applied to draw-rod *A* from a pneumatic or hydraulic cylinder, draw-sleeve *B*, which houses the lower end of lever *C*, is retracted. This causes the lever to swing, and lever block *D* on the short end of the fulcrum forces jaw *E* to close radially. The lever has a mechanical advantage favoring the jaw movement so that high gripping pressure is obtained.

Lever ratios may be as high as 5 to 1. This, of course, reduces the amount of jaw movement relative to draw-rod movement. Even though

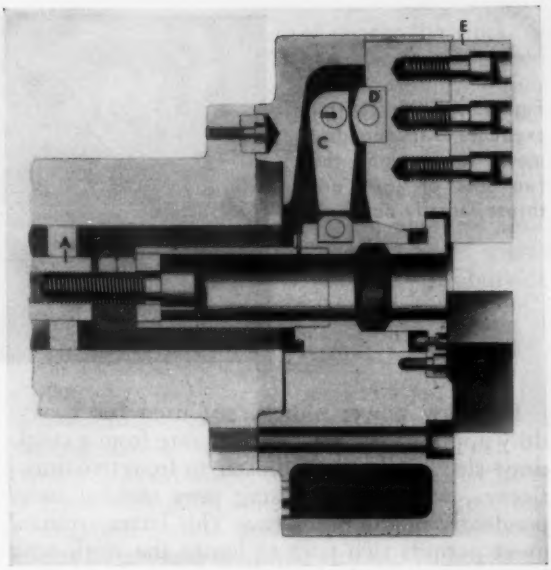
there is a high lever ratio, not more than 60 per cent efficiency can be expected from this type of chuck. How far the work is held from the face of the chuck will also affect the efficiency.

In Fig. 2 is illustrated how the jaws, or gripping pads, operate in a bayonet slot and pin type chuck. An advantage of this design is that the gripping pads are out of the way during loading and unloading. When the pads are brought into action, they pull straight in against the work, thus preventing distortion of thin-walled sections. Pads of different length can be interchanged in the same chuck body, and they can be designed for gripping externally or internally.

Power chucks have from two to six jaws. Since the gripping surface of most work is round, the three-jaw chuck finds wide use. This design affords equalized gripping on the perimeter with a minimum of distortion.

Two-jaw chucks hold square and odd-shaped work. For the latter, good top-jaw design is essential. A two-jaw chuck can often be adapted to work that appears about impossible to hold. Frequently on complicated pieces it is practical to have one stationary jaw and one movable jaw. A swinging top jaw proves useful in locating the work.

Symmetrical parts like valves and other plumbing fixtures can be held in indexing type two-jaw chucks, and the various sides of the work machined in sequence. On many of these chucks, the jaws can be indexed without stopping the machine, so there is less handling involved and less chance of scratching or nicking the work.



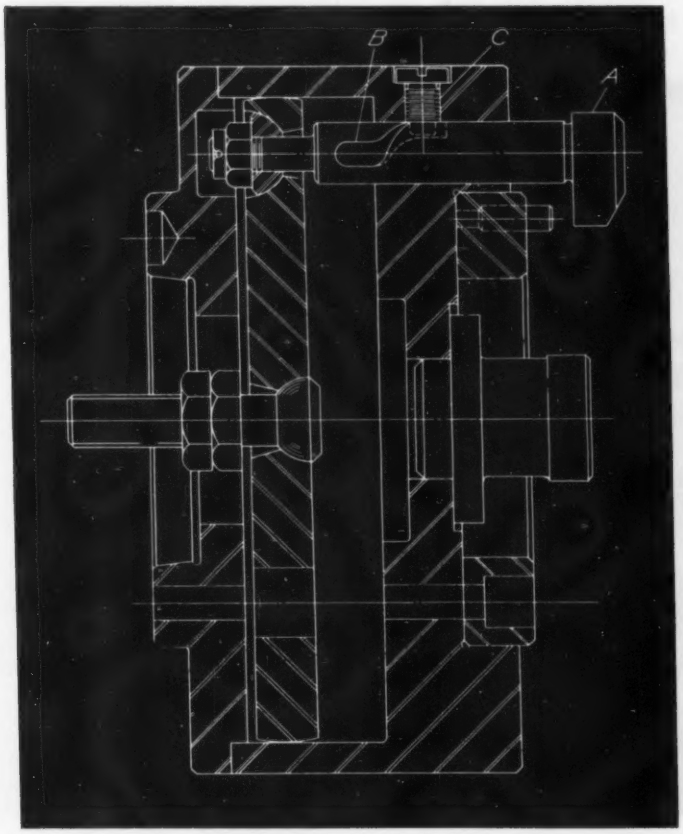




**Fig. 1. (Above) In lever type power chuck, the longitudinal movement of draw-rod (A) is converted to a radial movement of jaw (E).**

**Fig. 2. (Left) When pad (A) moves laterally, it also rotates because of the engagement of slot (B) with the fixed pin (C).**

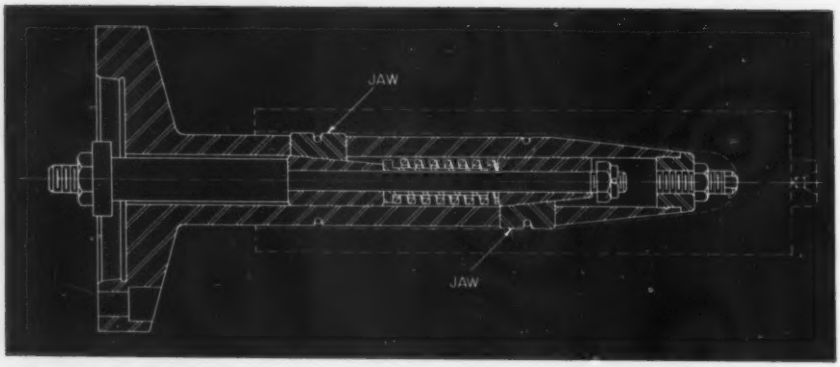



Fig. 3. As the central expander of the mandrel moves to the right, the two sets of jaws are thrust radially outward.

Four-jaw power chucks are used for heavy-duty applications. The jaws operate from a single draw-sleeve, moving in unison; or from two draw-sleeves, with two opposing jaws moving independently of the other two. This latter arrangement permits two jaws to locate the work with low pressure and the other two jaws to then apply a heavy gripping pressure. Sometimes the draw-sleeve operating the two locating jaws is spring-loaded.

How good a job can be done by a power-operated chuck depends largely on the design of its top jaws. Even with extreme pressure, the jaws will not hold work adequately if their gripping surfaces are improper. On a compensating type chuck, for example, if the top jaws have too wide a contact area with the work, the master jaws are unable to rock, and a great amount of force is thrown on the chuck and tailstock centers.

Other power chucks also may have top jaws with too wide a contact area, particularly for rough forged or cast surfaces or for heavy work. It is usually necessary to dig into the surface—something a wedge-shaped jaw can do more effectively than a wide jaw. Here, serrations and pointed tool-steel inserts help.

On the other hand, "wrap-around" top jaws reduce distortion of thin-walled sections. Such jaws give added support around the work, so the holding pressure required is less. If the machining operation drastically reduces wall thickness

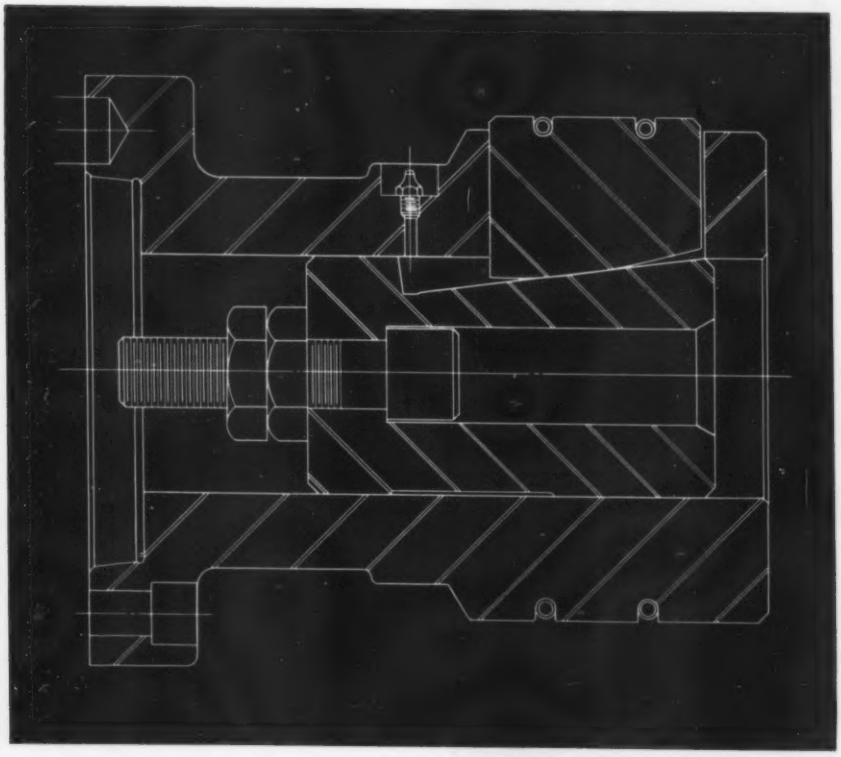


Fig. 4. Bottoms of jaws of compensating type mandrels are curved, have an angular contact with expander, and are able to rock.

at or near the gripping surface, it may be desirable to design a circuit that decreases chucking pressure as the section decreases in area.

Where spindle speeds are excessive, power chucks with aluminum bodies are often employed to reduce weight. Chuck jaws may also be made of aluminum, with steel inserts for the gripping surfaces. A high spindle speed combined with a heavy work-piece adds to the problem of centrifugal force. As a safety measure, there has been considerable development in power chucks which lock as pressure is applied. To unlock these chucks requires an internal force from the movement of the draw-rod.

### Mandrels

Power-operated mandrels support hollow work internally by forcing jaws, sleeves, or segments to expand radially. Mandrels have either a push or pull action. The push type, Fig. 3, has an expander which, in moving away from the machine spindle, thrusts the jaws of the mandrel outward. It is generally used on small-diameter work. In the pull type, the jaws move out when a draw-stud is retracted. Pressure is concentrated in relatively small areas.

The mandrel illustrated has two sets of three equally spaced jaws. Bottoms of the jaws have an angular contact with the expander member. Jaw movement is relatively small. Hydraulic cylinders are the usual actuating means of producing high gripping pressures.

Two mandrels—one on the headstock and one on the tailstock—can be used to hold a long length of tubing. These are of the compensating type, with the jaws free to rock to center the work, as can be seen in Fig. 4. For work with one closed end, mandrels have locators which are either integral or separate members. The latter are adjustable to tubing of different length. The locator keeps the work away from the shoulder of the mandrel so that the open end can be faced.

Different materials are used for mandrel jaws. These may vary from high-impact steel where heavy stock removal is required, to rubber for holding glass tubes for a grinding operation.

### Collets

Bars, tubes, and cylindrical work having a smooth and accurate gripping surface can be readily held externally in collets. The collet body is lined with pads which adapt it to the cross-section of the work. Axial splits in the collet body afford an amount of spring closure. Pads are designed to accommodate hexagonal, square, and special shapes as well as round cross-sections. Locators can be set in the collet body to position the work axially.

These devices have a limited radial movement, but exhibit high gripping pressure. There are several standard power-operated collets on the market, but many applications are of a special nature.

Long-bodied collets, such as the one shown in the heading illustration, are supported by a steadyrest to relieve the weight on the spindle bearings of the machine. Collets are often opened and closed for loading and unloading without stopping the spindle. This is best done in conjunction with a mechanical loader.

# Finding Small Angles with Tangent Formula

F. MURRAY

When the hypotenuse and the longer side of a right triangle are nearly alike, the small included angle cannot be accurately found from cosine tables, as the cosines of small angles change too slowly in value. This is more apparent when using the more common five-place tables.

In such cases the angle can be accurately found by the formula:

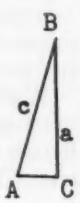
$$\text{Tan}\ \frac{1}{2}\ B = \sqrt{\frac{c-a}{c+a}}$$

As an example:

$a = 20.000$

$c = 20.004$

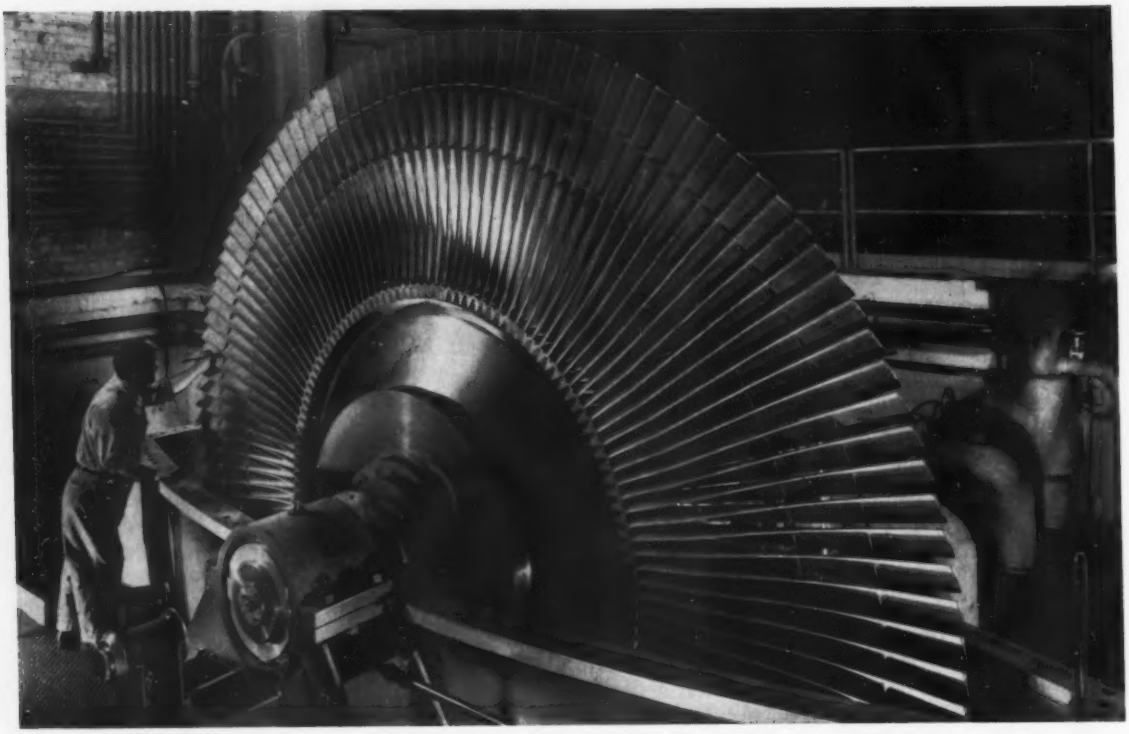
Find $\angle B$ to the closest 5 seconds.




$$\text{Tan}\ \frac{1}{2}\ B = \sqrt{\frac{20.004 - 20.000}{20.004 + 20.000}} = \sqrt{\frac{0.004}{40.004}} = 0.0099995$$

Rounding this figure off to 0.01000 and interpolating for seconds from a five-place table of tangents gives an angle of 0° 34′ 23″. Then $\angle B = 1°\ 8'\ 46''$. This is well within the 5-second tolerance required, as a seven-place table gives an angle of 1° 8′ 45″.

If the cosine formula had been used in place of the tangent formula, a value of 0.99980 would have been obtained. From a five-place table of cosines, this corresponds to an angle of either 1° 8′ or 1° 9′ and cannot be accurately interpolated.



## *For Kilowatt-hungry America . . .*

# ALLIS-CHALMERS UPDATES ITS BLADE-MAKING TECHNOLOGY

**W. C. FRAZIER**
**Steam Turbine Department**
**Allis-Chalmers Mfg. Co.**
**Milwaukee, Wis.**

BY THE BEGINNING OF 1959 the nation's electric-generating capability stood near 145,000,000 kilowatts, almost double the 76,200,000-kilowatt mark reached just seven years earlier. Of this total, four out of every five kilowatts were produced by steam turbine-driven generators. To meet this growing demand, turbine builders have had to turn out a better product within a shorter period of time.

As demands for power have increased, so have the complexities of steam-turbine design and production. Turbines of higher ratings and unique arrangements have forced manufacturers of this equipment to revise obsolete fabricating methods and to learn new ones. To keep pace with the increased production requirements, many plants have installed new and larger machine tools, often performing more highly specialized operations within finer tolerances than ever before specified. Some of the most notable advances have been in connection with the development, testing, and production of the long exhaust blades that are required in today's giant turbines.

With the average size of new turbine-generator units pushing steadily toward the 200-megawatt figure, exhaust areas and blade lengths have increased accordingly. The introduction of longer

blades has, however, brought new problems to the turbine manufacturer. Increasing blade lengths means greater twisting and tapering of the profiles so that the desired control of steam flow can be realized through the blade areas. These profiles must be precisely contoured and sized to extract the maximum work from the steam. At Allis-Chalmers Mfg. Co.'s Steam Turbine Department, the challenge is being met with an array of new machine tools.

Multiple-spindle blade millers cut the complex contours to the close tolerances required. As many as six blades can be handled simultaneously. Profiles of any length up to 50 inches can be obtained, with the longest currently in production having an effective length (port) of 46 inches. Blades of this size, the largest ever put into service, are operating in two cross-compound steam turbine-generator units manufactured by Allis-Chalmers. The first of these, rated at 321 megawatts, was built for the Detroit Edison Co., while the second, rated at 327 megawatts, was built for the Commonwealth Edison Co. (Chicago).

One of the new blade millers—this, a four-spindle model—appears in Fig. 1. Before the machines were installed, each exhaust blade was individually machined, one side at a time, by tracer-controlled planing and shaping equipment. The millers utilize the same operating principle; that is, the cutting tools are hydraulically positioned and guided by a follower on a duplicating model. Current production is greatly accelerated, however, because of the processing of several work-pieces simultaneously. In addition, blades are now made that were not possible with previous tooling, and some operations which were required in the past have been eliminated. For machines milling blades up to 20 inches in length, cutter speeds as high as 2200 rpm are used. Speeds for those milling larger blades range up to 1500 rpm. Carbide-tipped milling cutters are used in most cases, with cutting speeds frequently exceeding 1000 fpm (feet per minute).

The complete blade profile, including platforms for blade stiffeners, a step to accommodate an erosion shield, and the approximate root platform, is machined in a single operation. While production on the machines varies depending on the particular blade size and the amount of stock removal, a typical figure for milling six rough-forged blades 13.25 inches long with 3/16-inch average stock removal per surface is about 16 per cent of the time required by previous methods. In addition to saving time, the multiple-spindle blade millers turn out a more uniform product.

The roots of the blades, by which they are attached to the spindle discs, are among the most highly stressed sections of the turbine-generator unit. The root of a 46-inch exhaust blade, for instance, must hold the blade in position against centrifugal forces in the neighborhood of 250,000 pounds, since maximum tip speeds are in the supersonic range. This requires high-strength material. Previously, the root contour was formed in separate operations that were performed on milling and broaching machines.

An electromechanical, horizontal broaching machine, Fig. 2, now combines both steps. Instead of first milling and then broaching the roots, which was difficult and time-consuming because the broaching tools had to be precisely aligned with the milled grooves, the new machine produces a finished root with two quick passes—a roughing cut and a finishing cut. (Because of the ample stroke of the broaching machine, tools can be designed to rough and finish some of the




**Fig. 1. Four 46-inch blades being milled here are for the low-pressure turbine of a 250-megawatt, 3600/1800-rpm unit. The duplicating model in the foreground is molded of epoxy resin.**

shorter blade lengths in a single pass.) Tolerances are held within 0.0005 inch.

Some of the most difficult problems the design engineer must face concern blade and disc vibration. With the lengths of operating 3600- and 1800-rpm exhaust blades now at 26 and 46 inches, respectively, the solution of these problems has required extensive testing and development work, utilizing the most modern devices available. One of these is a rotating blade-vibration test stand. In the heading illustration, a 46-inch blade disc is shown on the stand. The stand is also used to run out discs to stress levels simulating actual operating conditions.

The shaft on which the disc is shrunk is driven by a 500-hp steam turbine. A similar turbine is provided for braking the disc, which rotates inside a steel housing at pressures as low as 0.2 inch mercury, absolute.

Barium titanate (molded ceramic piezoelectric crystals) is cemented to the blades undergoing tests. Leads from the crystals are brought out through the center of the shaft to coin-silver slip rings. The vibration signal is transmitted to test instruments where it is analyzed. Both shrouded and unshrouded blades are analyzed, as well as blades with and without stiffeners, to assure the reliability of the steam turbines.

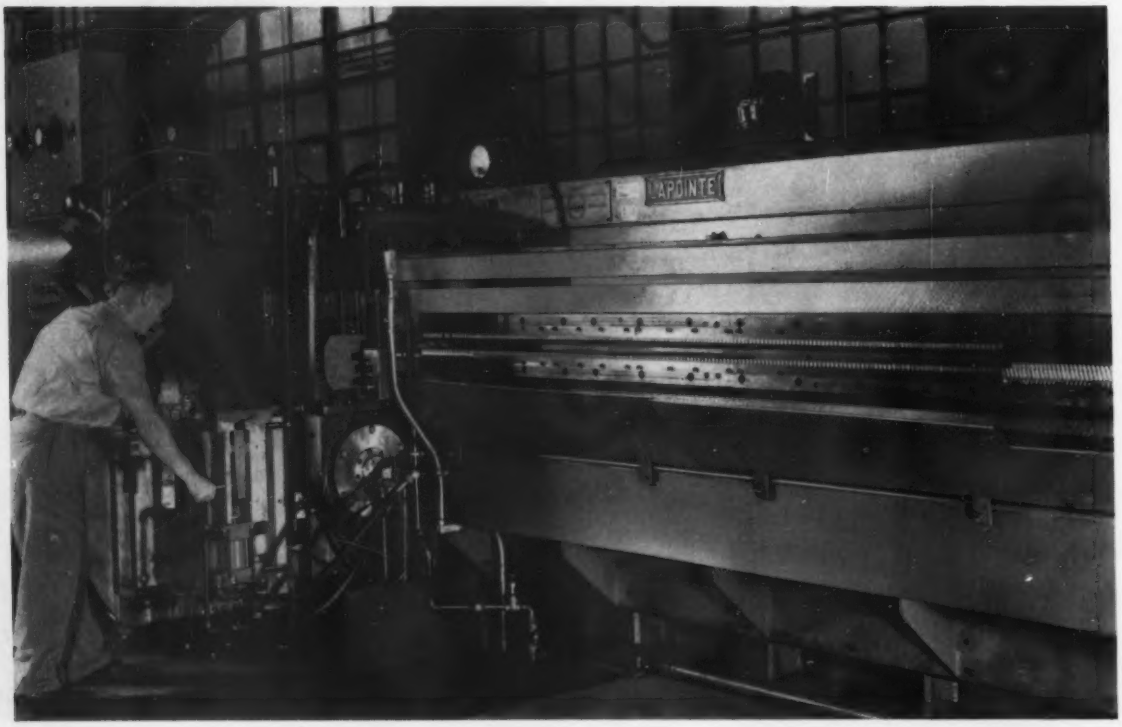
## Changing from Spur to Helical Teeth

Changing from spur to helical gears without changing the center distance is usually quite easy to accomplish. The width of face and the pitch of the gears will determine the minimum helix angle, as there should be a tooth overlap slightly greater than the circular pitch, or the distance from tooth to tooth. It is usual to keep the helix angle at a minimum to prevent heavy thrust loads.

The easiest method is to select a smaller number of teeth for both gear and pinion, and to compensate for this by selecting a helix angle that will increase the pitch diameter to that of the spur gear. For instance, a 30-tooth, 10-pitch spur pinion and a 60-tooth, 10-pitch spur gear can be modified to a 29-tooth pinion and a 58-tooth gear of 10 normal diametral pitch, 14° 50′ helix angle, or they can be changed to a 28-tooth pinion and a 56-tooth gear of 10 normal diametral pitch, 21° 2′ helix angle.

All three sets of gears use the same blanks and are cut with the same 10-pitch hob. They will operate on the same 4.500-inch center distance. It is not economical to retain the same numbers of teeth and modify the pitch, as this invariably results in a special pitch for which special hobs will be needed.—*The Adams Co., Dubuque, Iowa*

**Fig. 2. The root configuration of a blade for one of the rows of a cross-compound, double-flow steam turbine is being formed on this ram type broaching machine. Operator is loading blade into fixture, which is then indexed to broaching position.**



# *Money for Movements!*

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Enter as many articles as you like, but confine each to a single mechanism or movement.

## what you do

Send a scale drawing (or photograph—or both) that shows the operating principle and important parts involved. Clear blueprints or pencil drawings are acceptable, but free-hand sketches cannot be used.

Describe the *purpose* and *action* of the mechanism—*how* it does *what* it does. Your description need not be in polished English, but it should be clear and logical.

Mark details on drawing, such as levers, cams, and gears, with letters *A, B,* etc., and use corresponding letters to identify those details in the description; thus, "Lever *A* is operated by cam *B*." (A suggestion: See how articles in previous "Ingenious Mechanisms" sections have been handled.)

Substitute a diagram for the drawing, if necessary, to illustrate the arrangement of a complicated mechanism.

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# Fixture for Gaging the Position of Keyways

W. H. MORSON, Melton Mowbray, England

Accurately located keyways were to be machined in a large quantity of ground shafts. In addition, the need for economy in production required that a simple and efficient method be devised for gaging both the offset and the inclination of the keyways. The device shown in Fig. 1 was used to determine these errors.

The gage has a hardened steel body *A* mounted on a hardened and ground steel baseplate *B*. Capscrews secure the two members together and a bolt is employed at each corner of the baseplate to fasten the gage to a stand during use. A bearing hole, ground and lapped for a close fit with the work-piece *C*, extends through the width of

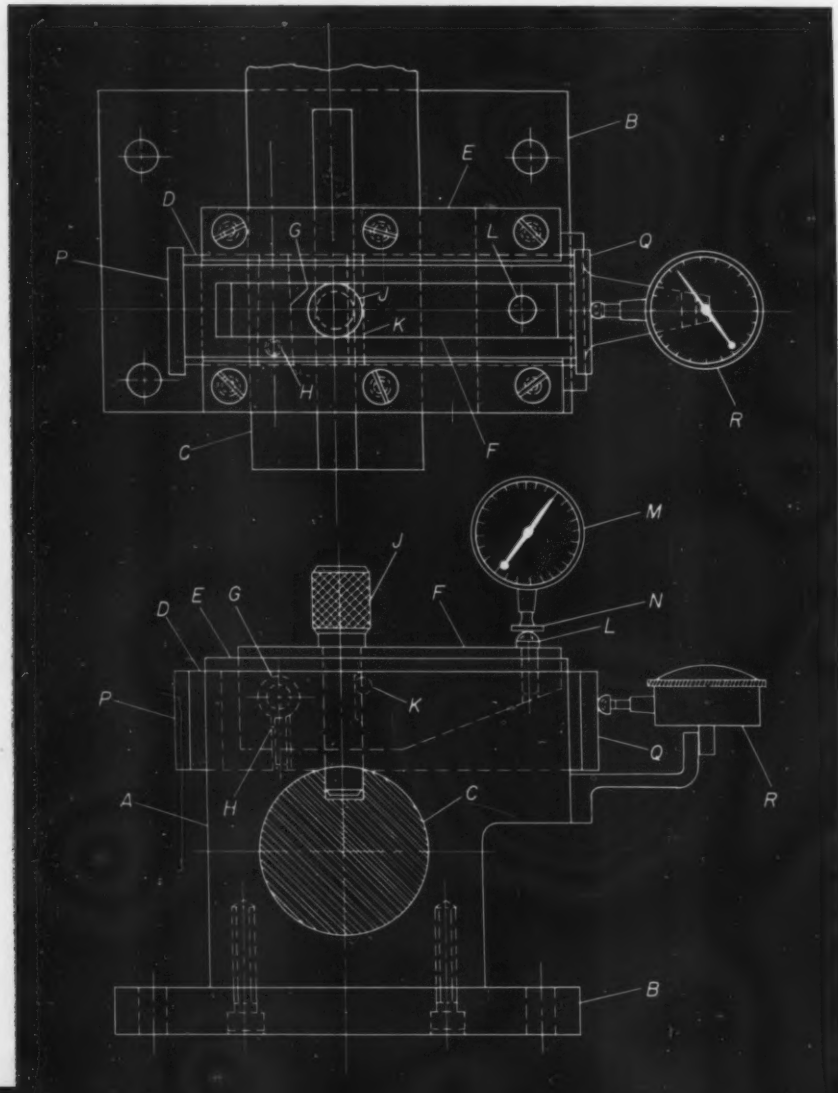



**Fig. 1. Gage used for determining the position of keyways in shafts. Both offset and inclination errors can be readily checked in a single setup.**

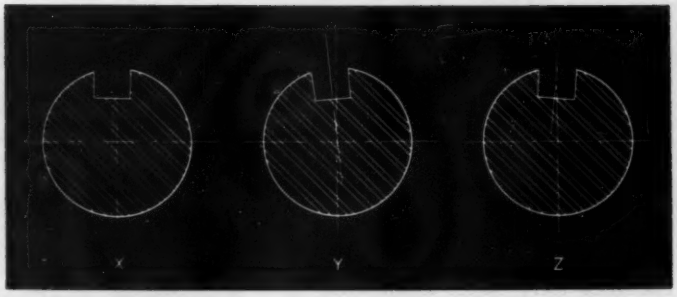



Fig. 2. Typical offset and inclination errors in the position of keyways.

the body and is parallel to the bottom of the baseplate. Across the top of the body in the center of its width is a deep rectangular slot having all sides accurately ground. This slot has its base parallel to the bottom of the gage and about 3/16 inch below the top of the bearing hole. The resulting intersection of the base of the slot and the hole is about 7/8 inch long and is centered on the vertical axis of the hole.

A steel slide *D*, also hardened and ground, is machined to have a T-shaped cross-section. Extending about 1/4 inch longer than the gage body, slide *D* is retained in the working position by two keeper plates *E*. Each keeper plate, being secured to the top of the body by three socket-head screws, bears lightly on the stepped sides of the slide. The slide is lapped into the horizontal slot to move freely and smoothly under light finger pressure, without vertical movement or side play.

A slot is machined through slide *D* for the major portion of its length. The width of the slot is about one-half that of the slide, but not less than one and one-half times the width of the keyway to be gaged. A rectangular arm *F* of hardened steel is lapped to fit closely in this slot. The arm is pivoted near its left-hand end on a pin *G* which is secured by a headless screw *H* in one side wall of the slide. A tapered bearing hole is reamed in the arm to suit a corresponding taper machined on the shank of the pin. The end portions of the pin which fit into the side walls of the slide *D* are cylindrical but of different diameters. The tapered surfaces of the pin and its bearing hole allow adjustment for wear, thus eliminating play between the parts. The arm, which can pivot about 2 degrees in each direction from the horizontal plane, has its top edge ground accurately flat and projects about 1/4 inch above the keeper plates.

A hardened and ground steel locator pin *J* has a shank of the same diameter as the width of the keyway in the work-piece. This pin is carefully lapped to fit smoothly in a hole in arm *F* and, at the same time, be precisely perpendicular to its top surface. Below the knurled head of the pin is a shoulder that limits the depth to which the shank enters a keyway being gaged. Member *J* is prevented from being completely withdrawn by a stop-pin *K* positioned across the arm slot. Pin *K* bears lightly against a flat ground for a short distance along the adjacent side of the locator pin. Secured in a hole in the right-hand upper end of the arm is a hardened steel pin *L* having a polished spherical head. The distance between the centers of pin *L* and locator *J* is about three times that between locator *J* and pivot pin *G*. Dial indicator *M* is fastened to a bracket (not shown) secured to the body and the spindle bears on the head of pin *L*. A large flat anvil *N* is fitted to the spindle to insure proper contact with pin *L* when the arm is slightly swiveled within the slide.

Rectilinear movement of the slide is limited by hardened steel plates *P* and *Q* which are fastened to opposite ends of the slide. The external side of plate *Q* is ground and lapped to provide a measuring surface for contact with the spindle of a dial indicator *R* affixed to a bracket mounted on the body.

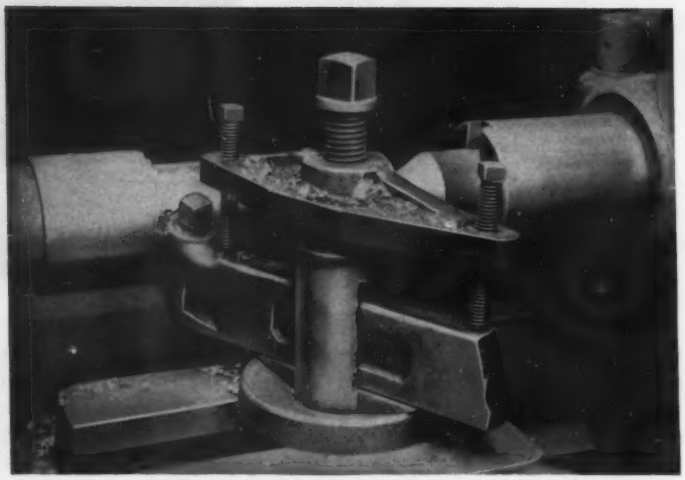
To use the gage, a work-piece is inserted within the bearing hole in the body, and locator pin *J* is pressed down allowing the lower end of its shank to enter the keyway as seen in Fig. 1. If the keyway is vertical, but located off the vertical axis of the shaft (Fig. 2, View X), the slide can be moved horizontally in the appropriate direction to allow the locator pin to engage the keyway. Dial indicator *R* is pre-set to a shaft having an accurately located keyway; thus this indicator records any offset of the keyway.

In cases where the keyway is inclined in either direction relative to the vertical center axis of the shaft, as shown in Views Y and Z of Fig. 2, arm *F* will pivot within the slide and also move horizontally with it to enable the locator pin to enter the defective keyway. The amount of inclination is denoted by the reading on dial indicator *M* which is magnified because of the relative center distances of pins *G* and *L* from the vertical axis of the locator pin. Dial indicator *M* is, of course, pre-set to a master shaft having an accurately located keyway. In this way, keyway location is readily checked in one setup.

# Auxiliary Support for Lathe Tool-Holder

H. J. GERBER, Stillwater, Okla.

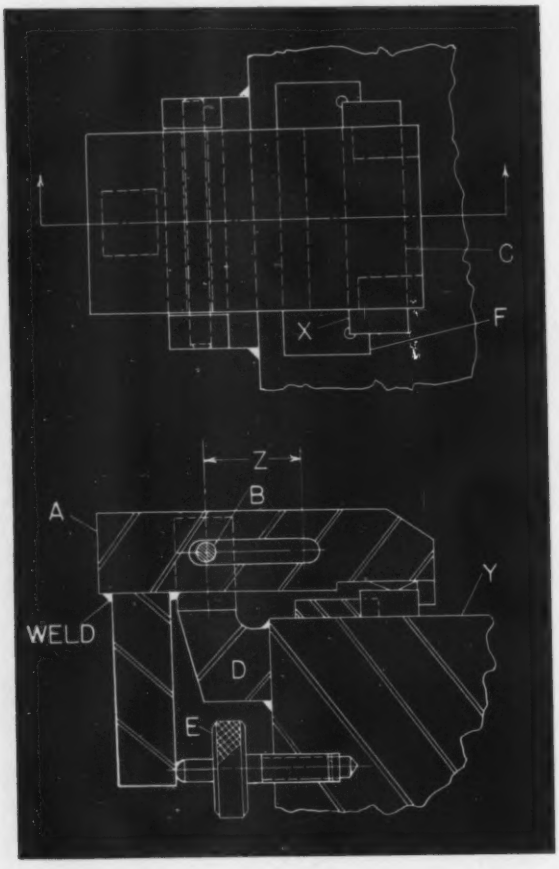
Downward slippage of a lathe tool-holder mounted on a conventional toolpost during the taking of heavy cuts and excessive chatter of the tool have been eliminated in one shop by the use of an overhead beam support on the tool-holder, as shown in the illustration. The modified toolpost is in frequent use on work held between centers.



Modified tool-holder with overhead beam support and set-screws for preventing shifting of a tool-holder or chatter under heavy cuts.

The auxiliary support consists of a piece of flat mild steel cut on a band saw to the shape shown. After boring a hole to enable fitting the support around the top portion of the toolpost, the support was welded to the post. A wedge-shaped gusset was welded from the toolpost outward toward each end of the support to provide additional stiffening.

Square-head set-screws have been provided in drilled and tapped holes at opposite ends of the beam. These set-screws are tightened at each end of the tool-holder after the holder and the convex wedge on which it rests have been properly set. The screws oppose any tendency of the tool-holder to shift under cutting pressures.




# Double-Acting Fixture Clamp

CLIFF BOSSMANN, Dayton, Ohio

A work-holding arrangement for jigs and fixtures that features two-direction clamping is here illustrated. With a single adjustment of a thumbscrew, the work-piece is clamped against both the locating surface of the part-nest and the base of a fixture.

Clamping member *A* is of welded construction and is pivoted on a pin *B*. The slot provided for the pin permits the two-way motion of the clamp and allows easy unloading of the work-piece *C*. Pin *B* is supported in a bracket *D* welded to the base of the fixture. A knurled thumbscrew *E* is carried in a tapped hole in the base. When moved to the left, this screw contacts the lower end of member *A* to clamp the work-piece in part-nest *F*.

After the part has been positioned in the fixture, the clamp is moved to the right a distance indicated by *Z* and placed over the work-piece. As the clamp is tightened by means of the thumbscrew, the work-piece is first forced against locating surface *X*. Additional turning of the screw pivots the clamp downward to hold the part down on the base (surface *Y*).

Two-way clamp for jigs and fixtures that is tightened by means of a single thumbscrew.



# MACHINERY'S PROBLEM CLINIC

**Mathematical problems in shop work and tool design submitted by readers of MACHINERY**

**Edited by HENRY H. RYFFEL**

## Calculating Dimensions for a Piercing Die

WILLIAM W. JOHNSON, Cleveland, Ohio

Dimensions $x$ and $y$ on the piercing die illustrated in Fig. 1 were calculated, using the diagram in Fig. 2, as follows:

SOLUTION:

1. $AG = BC + CD$
   $= 0.375 + 1.075$
   $AG = 1.450$
2. $EG = AG - AE$
   $= 1.450 - 0.9375$
   $EG = 0.5125$
3. $EH = EG \cos 45°$
   $= 0.5125 \cos 45°$
   $EH = 0.36239$
4. $EF = EH - HF$
   $= 0.36239 - 0.250$
   $EF = 0.11239$
5. $\sin \alpha = \frac{EF}{R}$
   $= \frac{0.11239}{0.755}$
   $\sin \alpha = 0.14886$
   $\alpha = 8°33'39''$
6. $\phi = 45° - \alpha$
   $= 45° - 8°33'39''$
   $\phi = 36°26'21''$
7. $x = R \cos \phi$
   $= 0.755 \cos 36°26'21''$
   $x = 0.6074$
8. $y = AE - R \sin \phi$
   $= 0.9375 - 0.755 \sin 36°26'21''$
   $= 0.9375 - 0.44845$
   $y = 0.4891$

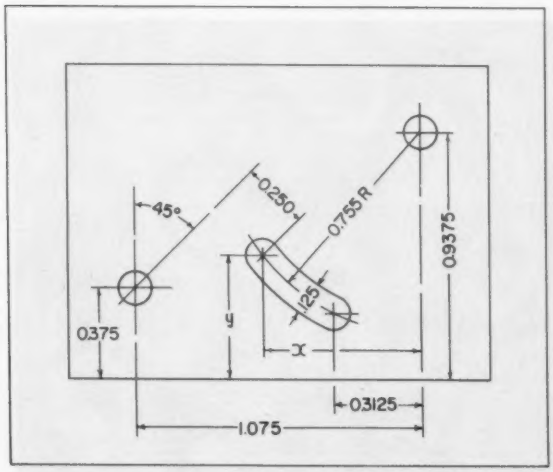



**Fig. 1. (Above) Piercing die for which coordinates (x) and (y) are required for jig-boring operation.**

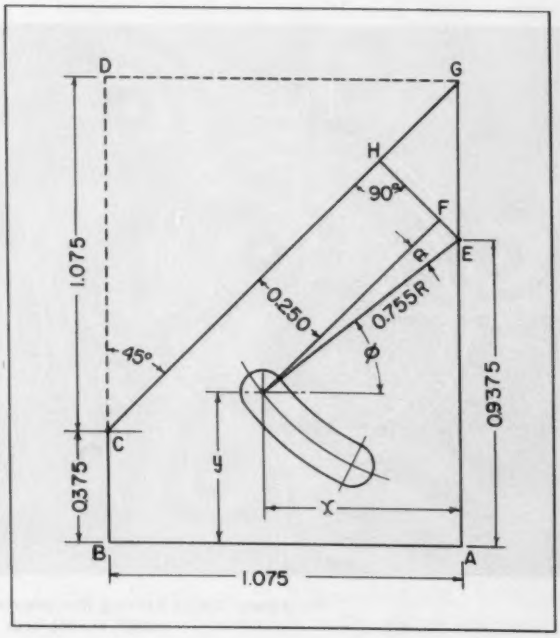
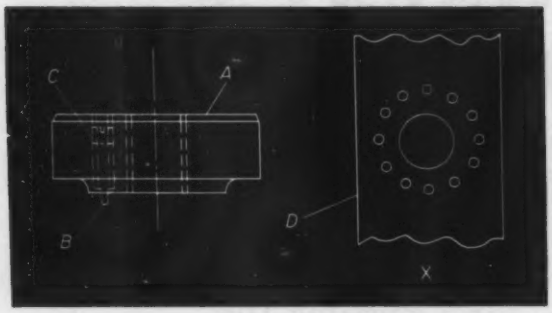



**Fig. 2. (Right) To calculate (x) and (y) dimensions, angles α and φ must be known.**

# SHOP KINKS




Spring plungers prevent the loosening of hand-operated screw type fixture clamps from excessive vibration during machining.

## Hand-Operated Fixture Clamps Secured Against Vibration

RICHARD MINSER, Cleveland, Ohio

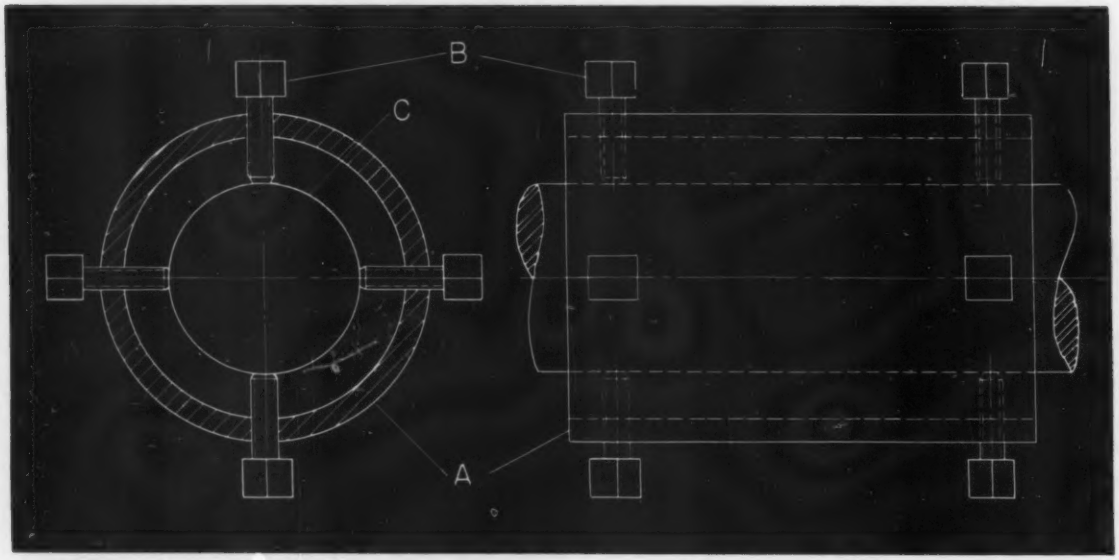
Production fixtures used on milling machines, shapers, and planers are subject to extreme vibration due primarily to the interrupted cutting encountered in such work. When excessive vibration is present, hand-operated screw type clamps used on these fixtures tend to become loose since only the friction on the knob face and in the threads holds the screw tight. To overcome this condition, a simple modification to the knob and clamp here illustrated will enable the screw to hold without excessive tightening.

The knob *A* is drilled and tapped to receive a small spring-loaded plunger *B* which is locked in place with a set-screw *C*. In addition, the face of the clamp *D* under the knob is spotted with a drill or indented with a center punch, as shown at X in the illustration. All burrs should be filed flush with the parent metal. A steel ball, a spring, and a set-screw can be used instead of a spring plunger. In this case, however, the retaining hole is not completely drilled through the knob, but enough metal is left at the bottom to act as a seat for the ball. The modification will permit a screw clamp to be set to the desired degree of tightness without danger of loosening from vibration. The tension on the plunger or ball can be varied to suit the application.

## Temporary Sleeve Bearing for a Center-Rest

FRANK L. RUSH, Woodbourne, N. Y.

When spot-turning a long, rough work-piece for rotation in a center-rest and considerable vibration occurs between the cutting tool and the




Temporary sleeve bearing that provides a true surface for rotating long, rough work-pieces in a center-rest.

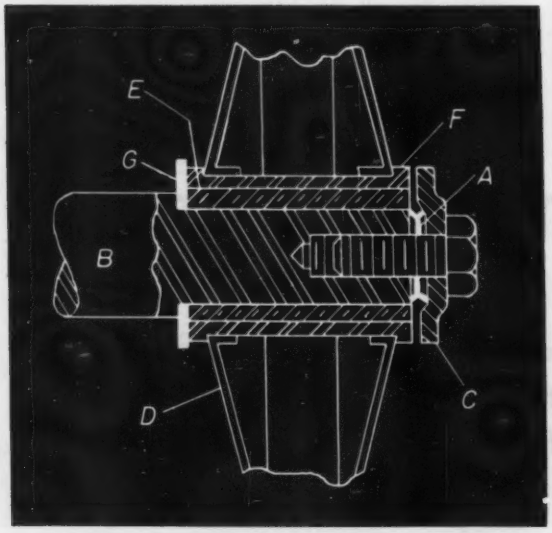
work, an uneven surface that is unfit for a true bearing may result. To avoid this condition, the temporary sleeve bearing here illustrated can be clamped to the work-piece and aligned to run concentric by eight adjusting bolts. Then, by mounting the center-rest under the sleeve bearing, the long work-piece will be supported so as to run true for the performing of lathe operations.

If piece of pipe *A* is used for the sleeve, it should be machined on the periphery as the rolls of the center-rest will bear directly against this surface. The adjusting screws *B* are of steel and are mounted in four tapped holes spaced equally around each end of the sleeve to provide the proper support for work-piece *C*.

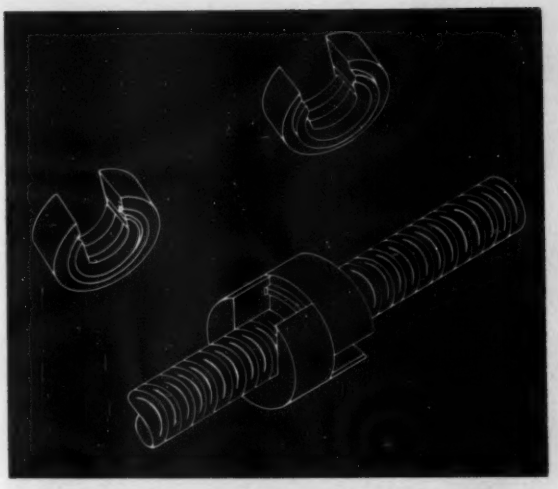
## Novel Wheel-Retaining Method

RICHARD WEBER, San Francisco, Calif.

A simple but unusual means of keeping a wheel on an axle is here illustrated. An external toothed lock washer *A* is placed between the axle *B* and a retaining washer *C*. A cap-screw secures the assembly to the end of the axle. Clearance is provided between the retaining washer and the wheel *D*, allowing the wheel to rotate freely on a bearing *E* pressed in the hub *F*. Part *G* is a washer. When the cap-screw is tightened, the lock washer engages both the stationary axle and retaining washer *C*. This engagement prevents washer *C* from turning with the wheel and loosening the cap-screw.




**Unusual arrangement for retaining a wheel on an axle incorporates an external toothed lock washer.**



**The split areas permit the nuts to be slipped over the screw, and the engagement of the rib on the one nut in the groove of the other keeps them in place when locked.**

## Split Nuts Form Quick-Adjusting Stop Collars

ERNEST JONES, New York City

Two interlocking split nuts can be quickly located at any point on a screw. Since they do not have to be run along the screw like ordinary nuts, they save adjusting time when used as stop collars. This is of particular advantage where the screw is long.

The accompanying illustration shows the nuts separately and in position on a screw. Both have a knurled periphery, an internal thread corresponding to the screw, and a split section that is a few thousandths of an inch wider than the major diameter of the screw. In addition, one face of one of the nuts has an annular groove, and one face of the other nut has an annular rib.

To position the nuts, they are slipped over the screw, with the groove and rib faces next to each other. With one nut held stationary, the other nut is rotated until it is jammed against the first. Neither can now slip off the screw, since the rib of the one nut is engaged in the groove of the other.

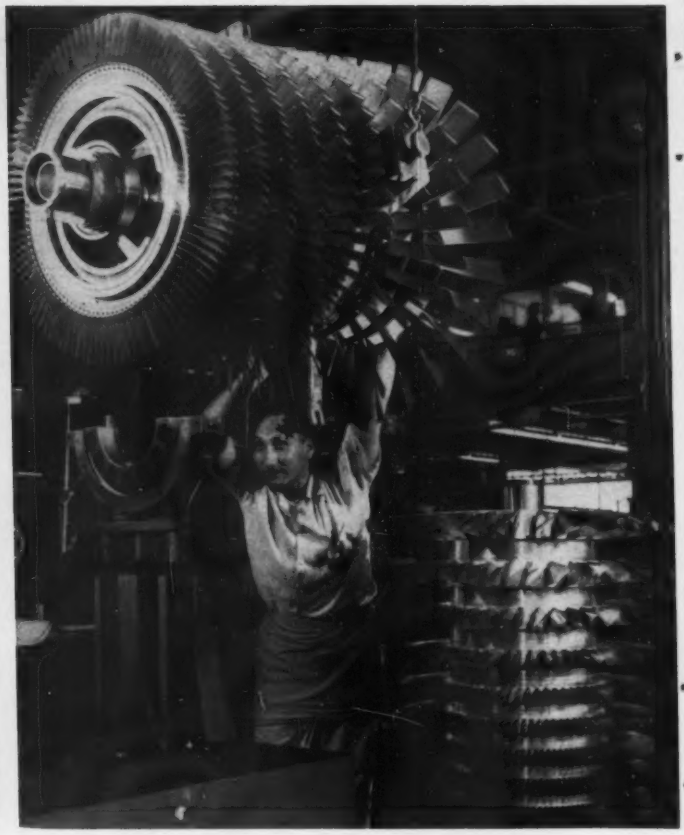
When the nuts are fully locked, the split areas should be approximately 180 degrees apart. This condition can be obtained by making the annular groove extra deep, then surface grinding the face of the nut a necessary amount.

* * *

A new process, Anocote, has been perfected by Harvey Aluminum of Torrance, Calif., to eliminate superficial corrosion of aluminum extrusions.




**JETSTAR FORGING**—A high-strength closed-die forging of 7075-T6 aluminum is straightened at Alcoa's Cleveland works. The forging, for the new Lockheed Jetstar, spans the fuselage and anchors the wing roots together. It is one of the largest used in the aircraft industry—85 inches long and 4 inches thick. "External" design cuts drag sharply.



**TITANIUM COMPRESSOR**—At Pratt & Whitney Aircraft, East Hartford, Conn., an alloy titanium compressor for a jet engine is hoisted onto a balancing machine. It is 443 pounds lighter than its steel counterpart, saving 4000 pounds of airframe weight. P & W currently consumes 50 per cent of the nation's output of the metal.

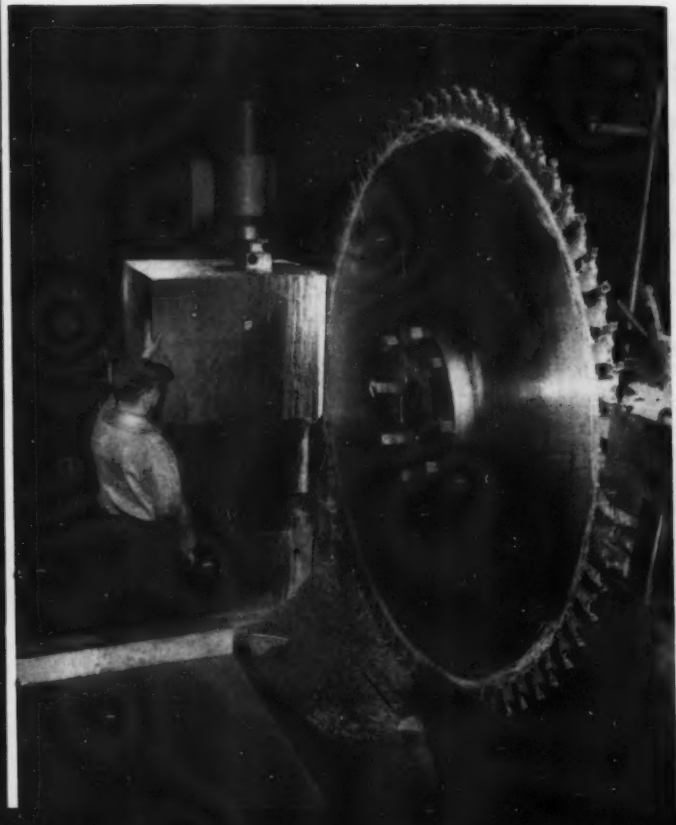
# In Shops Around the Country

**Camera highlights of some interesting operations performed in various metalworking plants throughout the nation by unique applications of machines and tools**

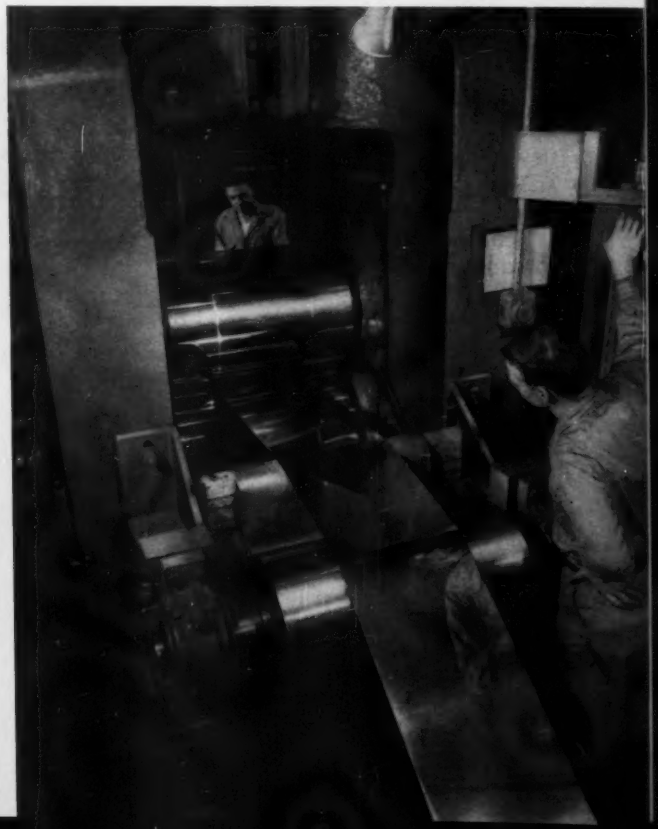


**WATER-SOFTENER TANK**—After being tack-welded, the seam of a water-softener tank is ready for submerged-arc welding, at General Ionics Corporation, Pittsburgh, Pa. The tank, fabricated of Allegheny Ludlum's 302 stainless steel, is welded at a rate of 40 inches per minute. Filler rod used is Type 308. Weld is later buffed.

**BLOCK CUTTER**—A. Finkl & Sons Co., Chicago, uses this 90-inch saw to cut its die-blocks, which run from 250 to 400 Brinell. Here a 28- by 28-inch nickel-chromium-molybdenum block is cut through in about three hours. Blade teeth are 18-4-2 steel, and operate at 29 to 35 fpm (feet per minute). The saw has an integral sharpening attachment.



**MIRROR FINISH**—This two-high temper mill imparts a luster and assures the correct hardness of stainless-steel strip produced at the new Coshocton, Ohio, plant of Universal-Cyclops Steel Corporation. The mill handles 18,000-pound, 24-inch coils. There is a 350-hp drive on the mill and a 300-hp drive on the reel. Strip reflects worker's image.



# 16th Edition of MACHINERY'S HANDBOOK

MACHINERY'S HANDBOOK. Sixteenth Edition. 2104 pages, 4 1/2 by 7 inches. Published by THE INDUSTRIAL PRESS, 93 Worth St., New York 13, N. Y. Price, $11; add 50 cents for postage overseas.

The new, Sixteenth Edition of MACHINERY'S HANDBOOK brings to 1,250,000 copies the total number of this volume printed since its inception in 1914. This latest edition reflects the rapid growth and accumulation of data in the mechanical industries, the large number of new American and British Standards, the changes in engineering and manufacturing practice, and the advances in new materials and alloys. These changes in data and technology have required extensive revision throughout the work. Over 500 new pages have been incorporated and the book has been enlarged by the addition of 192 pages to bring the total number in the Sixteenth Edition to 2104.

The size and format of MACHINERY'S HANDBOOK remains the same as its predecessors—compact, handy, and easy to use. This objective of keeping it a handbook in the true sense of the word has been attained by careful, painstaking editing to achieve compactness and as clear a form of presentation as possible.

The section on screw-thread systems, probably the most widely used, has been completely revised to reflect the latest changes in screw-thread standards. Included are tables of dimensional data for all classes of Unified threads including the several new thread series recently added, and hole sizes for tapping based on the new minor diameter tolerances.

New designations applicable to ground-thread taps have been added. Recommended tap limits to achieve the various classes of fits in the Unified thread series are also included.

Data concerning the diametral pitch knurls recommended as providing good tracking by the American Standard are presented, as well as tolerances for work diameters before and after knurling.

New sections have been added, giving formulas and tables for curved beams such as are used in machine frames; pipe columns; round, rectangular, and square plates; cylinders subjected to internal and external pressure; tubes and shells.

A new seventy-two-page section gives standard descriptive and dimensional data for all types of ball, roller, and needle bearings. Besides dimensional and tolerance data for inch and metric bearings, there are data pertaining to shaft and housing fits, clamping and retaining methods, bearing life, radial- and thrust-load ratings, selection procedure for ball and roller bearings, equipment loads, and bearing capacity.

The subject of gearing has always been given careful attention in MACHINERY'S HANDBOOK. Advances in fine-pitch precision gearing called for the inclusion of data on enlarged spur and helical gears for seven teeth up, composite-error inspection, checking pressures, indicator limits, angular-position errors, angular backlash, and a complete tabular description of data for specification on drawings. This is the first handbook to give the exact formula and tables of data for the selection of helical-gear milling cutters in the production of milled gears for experimental and replacement purposes. Increased use of double-enveloping type worm drives in machines and machine tool applications has increased the need for tables of horsepower ratings and other data for various standard drives, which are included.

The data for designing and winding springs have been supplemented by a new section giving a detailed description of the most widely used spring materials, their strengths, moduli of elasticity, service factors for various applications, endurance limits, and working stresses.

The widespread use of involute splines and serrations in place of straight splines has necessitated a new forty-three-page section giving complete design data, formulas, and dimensions in tabular form for the design, production, and specification of the various types of spline and serration fits.

Data and information from the latest American Standards have been included, wherever possible, throughout the wide range of Handbook topics. Comparable data and information from a large number of British Standards have also been given to provide a reliable reference on British practice.

These highlights indicate only some of the details of the more important features of the new and revised material that has been incorporated into MACHINERY'S HANDBOOK in its Sixteenth Edition. Other new or revised subjects given extensive coverage include self-tapping screws, tapers, screw-thread inserts, washers, studs, strength of threaded connections, conversion tables, wire and sheet-metal gages, wire rope, tables of involute functions, bolts, screws, nuts, washers, mechanics, grooved pins, taper pins, grinding, polishing and lapping, flat belts, V-belts and sheaves, transmission chains, flywheels, shafts, single-point cutting tools, carbide boring tools, welding, brazing, hard-surfacing, heat-treated steels, and metal cutting.

MACHINERY'S Reference Section

# HOW TO AVOID DIE-PLATE FAILURES

FEDERICO STRASSER, Santiago, Chile

October 1959

# How to Avoid Die-Plate Failures

FEDERICO STRASSER, Santiago, Chile

IN A STUDY of a large group of unsuccessful cutting dies the cause in most cases was found to be some failure of the die-plate, such as cracking, breakage, spalling of the cutting edges, warpage, and distortion. These impairments generally make a die-plate useless, necessitating its replacement. Nearly all serious damage can be traced to one or a combination of the following reasons: improper tool-steel selection, incorrect tool design, inadequate heat-treatment, poor tool construction, faulty grinding, and unsound use of the tool.

### *Choosing a Tool Steel*

Selection of a tool steel for a given application is not easy since the choice depends on many interrelated and interdependent factors. Aside from the basic function of the tool, other details to be considered are its size and shape, the accuracy to which it is to be made, the working stresses involved, the toolroom facilities available, the admissible cost, and the characteristics of the stamping (including shape, dimensions, kind of stock, shearing strength, and surface finish). These factors must then be correlated to tool-steel qualities such as wear resistance, toughness, nondeforming property, type and duration of heat-treatment, and ease of grinding.

Tool-steel makers produce many different grades in order to satisfy every possible requirement. However, in diemaking, especially in the case of die-plates for cutting dies, we can simplify the selection because more than 95 per cent of all applications can be satisfied by four grades currently produced by the majority of tool-steel makers. These grades are the water-hardening, straight-carbon and low-alloy; oil-hardening low-alloy; air-hardening medium-alloy; and air-hardening high-alloy steels.

Water-hardening tool steels have the greatest tendency to crack in hardening. Consequently, they should only be used in cases where the tool members are simple, regular, and uniform in shape; where the minimum distances between cutting openings and die-plate edge are large; and where the distortions in hardening do not matter because either dimensional tolerances are large or corrective grinding is intended. After heat-treatment, these steels have a high degree of hardness at the outer surface but the penetration is shallow and the core, comparatively tough. This circumstance, combined with the fact that water-hardening steels possess moderate resistance to abrasion (the cutting edges soon lose their sharpness), makes their use advisable only for short-run dies. Against these disadvantages, water-hardening steels are low in cost, easy to

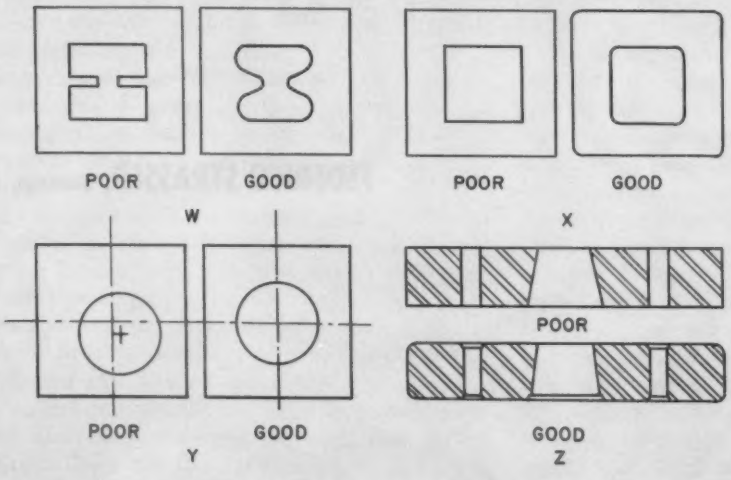



**Fig. 1. Generous filleting seen in View W; rounded corners, View X; symmetrically located die openings, View Y; and rounded edges, where practical, View Z, all contribute to good design of die-plate openings.**

machine, easy to harden, easy to grind, and readily available.

Oil-hardening steels have a greater resistance to cracking and warping. They are, therefore, preferred for die-plates with somewhat irregularly shaped cutting openings and certain other design difficulties. There is much less of a tendency for these steels to distort and change in size during hardening. Die-plates of this grade of tool steel have a longer useful life because the hardening penetration is deeper, and the wear resistance is greater. On the other hand, the oil-hardening steels are, due to the deeper hardness penetration, less shock resistant. Consequently, die members of this grade must be better built, especially with regard to alignment and stiffness, in order to avoid cracking or chipping of the cutting edges. Oil-hardening steels are comparatively low in cost, readily available, relatively easy to machine, and fairly easy to harden and grind.

The tendency of a die-plate to distort and change in size during heat-treatment is further reduced when air-hardening medium-alloy steels are used. Expensive and time-consuming regrinding and other corrective operations after the heat-treatment are, therefore, not required. These steels may be used for precision dies and for troublesome irregularly shaped dies, such as those having thin sections adjacent to heavy sections. The useful lives of die-plates made from these steels are much longer because there is even deeper hardness penetration and greater abrasion resistance than that exhibited by the oil-hardening grades. However, air-hardening steels are more expensive and more difficult to machine, heat-treat, and grind.

Air-hardening high-alloy steels are used where extremely difficult conditions exist, such as great internal stresses or a marked tendency to crack or warp. Examples are intricate cutting die-plates having severe variations in shape and size. In the case of these steels, all the advantages and disadvantages of the previously considered grades are increased and more accentuated. They have the longest life, best resistance to abrasive wear, greatest freedom from distortion and size change in hardening, and excellent edge strength; but they are higher in cost, less shock resistant (require perfect tool alignment), and are more difficult to machine, heat-treat, and grind.

### *Correct Tool Design*

If a die-plate made from hardened tool steel is subjected to excessive stress, it will crack or break. These failures may be caused by two kinds of forces—internal stresses built up during the fabrication and heat-treatment, and external operational forces. Both phenomena may act separately or in combination but the results are the same—cracked and broken die-plates. Sometimes it is impossible to determine exactly which is the real cause of failure.

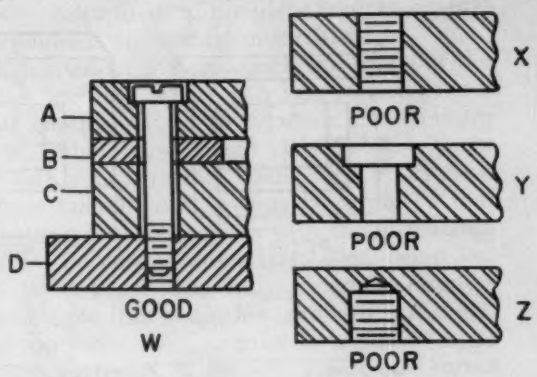



**Fig. 2. The use of clearance holes in die-plates for holding screws is good practice. Other arrangements may lead to die-plate failures.**

Internal stresses in die-plates may have several causes. However, the chief one is nonuniform cooling of the part during quenching. This trouble in turn is influenced by the design of the tool component. Designs favorable for the creation of internal stresses during quenching are also those that structurally weaken the die-plate by having stress concentration zones.

In order to reduce the danger of die failures to a minimum and thus be able to employ the cheaper grades of tool steel, the following basic rules of design should be heeded:

1. Try to balance section masses. If possible, avoid adjoining thick sections to thin ones. If not, make the passage between them smooth and use generous filleting (Fig. 1, View W).

2. Round off sharp corners and re-entrant angles (Fig. 1, View X). This not only prevents internal stresses but strengthens the die-plate mechanically.

3. Locate die openings symmetrically in order to obtain uniform cross-sections (Fig. 1, View Y).

4. Round off top and bottom edges of holes in the die-plate not used for cutting and the bottom edges of cutting openings. Wherever practical, also round off the corners and outer edges of the die-plate (Fig. 1, View Z).

5. For fastening, use screws which pass through a clearance hole in the die-plate into a

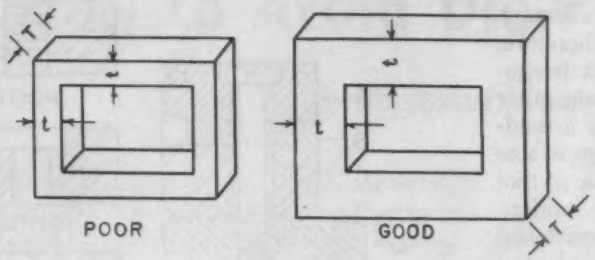



Fig. 3. Material around the blanking opening should be of sufficient cross-section. Good design (right) requires dimension (t) to be at least 1 1/2 to 2 times (T) in small dies and 2 to 3 times (T) in large dies.

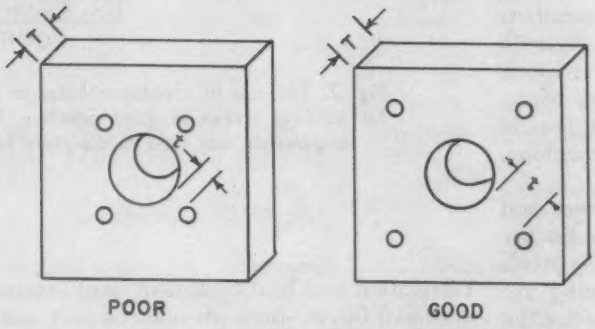



Fig. 4. The location of auxiliary holes in relation to cutting holes is also important. Dimension (t) in terms of die-plate thickness (T) should be about one-half that given in Fig. 3.

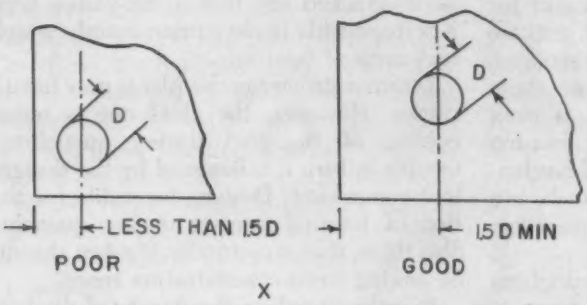



Fig. 5. Maintain a minimum distance between auxiliary holes and the edge of the die-plate. Such holes should not be in line with any of the cutting edges.

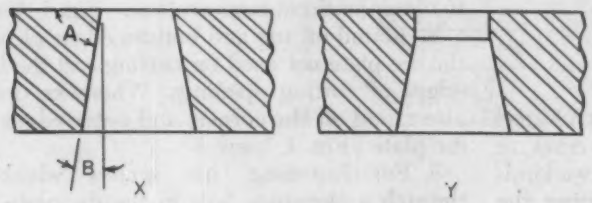



Fig. 6. Fully tapered die openings (View X) are favored for low-strength stock, thin stock, and short-run operations. High angular clearances (angle B) improve the cutting action.

threaded hole in the die-shoe. In Fig. 2, View W, the recommended method of securing the stripper plate *A*, the stock gage *B*, and the die-plate *C* to the die-shoe *D* is illustrated. Reject other designs such as through-threaded holes (View X), countersunk holes for fillister-head screws (View Y) because of the unbalanced design, and blind threaded holes (View Z). Even blind holes having smooth cylindrical walls cause cracking due to nonuniform cooling during quenching.

6. Leave an ample section of steel around the blanking opening. Vary the section thickness with the size and contour of the opening. It is good practice to leave 1 1/2 to 2 times the die-plate thickness in small dies and 2 to 3 times in large dies (Fig. 3). Use the lower values for simple, regular die openings and the higher values for the more complicated shapes.

7. The distance between blanking apertures and auxiliary holes such as small holes for piercing and holes for clamping alignment may be made smaller, about half that given in the previous item (Fig. 4).

8. Locate any auxiliary hole in the corner of a die-plate so that the minimum distance between the edge of the plate and the center of the hole is at least 1 1/2 times its diameter, as shown in Fig. 5, View X.

9. Do not locate auxiliary holes in direct line with cutting edges as this may cause cracking (Fig. 5, View Y).

The die-plate thickness should be checked for strength. This is done by means of the following empirical formula which gives approximate values:

$$t = \frac{K\,A\,S}{33}$$

where

$t$ = die-plate thickness in inches;
$K$ = shearing strength of the stock in psi;
$A$ = cutting perimeter in inches;
S = stock thickness in inches.

Any method which helps to reduce the cutting pressure helps to avoid die-plate failures. Several such methods are worthy of mention.

First, consider the cross-sectional shape of the cutting openings. There is a long-standing, universal controversy as to whether the straight-walled, fully tapered shape (Fig. 6, View X) or that with a top parallel land (View Y) is best. Without taking sides, it must be admitted that the cutting process is easier with the first design because the cutting angle is smaller, being less than 90 degrees. The fully tapered design is favorable for thin stock, low-strength stock, and short-run tools. High angular clearances (angle *B*) are preferred whenever possible. Correct punch clearances also contribute greatly to holding the cutting pressure to a minimum.

Finally, the cutting pressure can be reduced by inclining the cutting edges of the punches and/or the die-plate. A few typical shapes are shown in Fig. 7. It is important to balance the cutting action in order to avoid flexural stresses which would quickly destroy the cutting edge and thus cause premature die-plate failure.

Another detail of tool design which bears a direct relation to die-plate failure is the location of the tool shank. In fact, if the shank is not coincident with the center of pressure (Fig. 8) during the operation, flexural stresses are set up which can cause the die-plate to chip or crack.

### *Heat-Treatment*

Die-plates are usually hardened. This operation must be done carefully or there is good probability of failure. Of course, a complete outline for heat-treatment cannot be given here, but a couple of details which must be taken into consideration should be mentioned.

First the steel grade must be known in order to avoid any doubt about the heat-treatment procedure. It is good practice to stamp the grade of

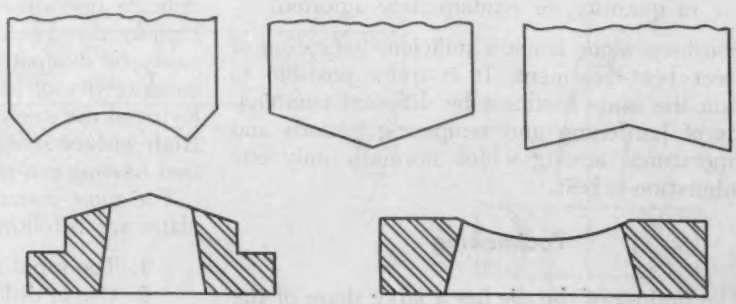


**Fig. 7. Inclined cutting edges on the punch and/or the die-plate reduce cutting pressure. Methods of balancing the cutting action on punches (above) and die-plates (below) are shown.**

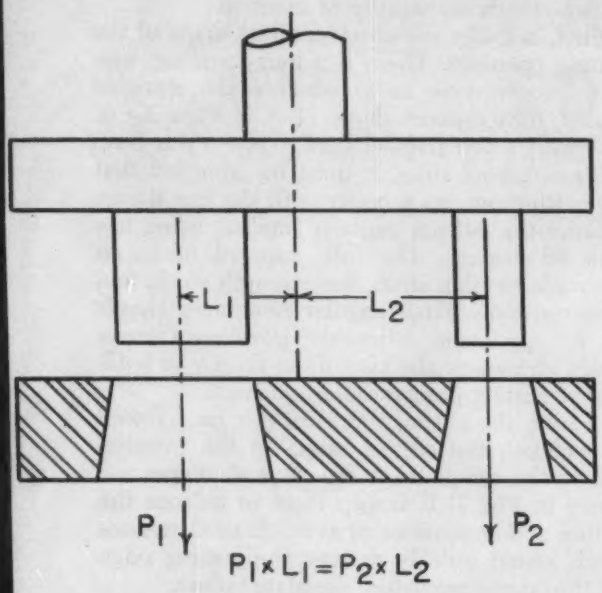



**Fig. 8. The shank of the die should be located at the center of pressure to prevent flexural stresses from causing damage to the cutting edges.**

tool steel on the side of the die-plate. Avoid especially the following causes of failure—those most frequently occurring in the heat-treatment of tool-steel components:

1. Too low a heating temperature;
2. Quenching too slowly;
3. Too high a heating temperature;
4. Decarburizing the surface metal;
5. Failure to preheat properly;
6. Failure to temper immediately after quenching;
7. Nonuniform chilling;
8. In water hardening, using quenching liquid that is contaminated, insufficient in quantity, or inadequately agitated.

Hardness alone is not a sufficient indication of correct heat-treatment. It is quite possible to obtain the same hardness by different combinations of hardening and tempering periods and temperatures, among which normally only one combination is best.

### *Toolmaking*

The builder of the die has a large share of the responsibility for preventing die-plate failures. Among the measures at his disposal that contribute to the production of successful die-plates, the following are especially prescribed:

Maintain the specified tolerances strictly. The accuracy of stampings cannot be better than the precision with which the tool has been made.

Avoid bellmouthed die openings (Fig. 9, View W). They increase the cutting load and cause other inconveniences.

Make the inner walls of the cutting openings smooth in order to prevent their clogging with blanks and slugs.

Provide the die opening with as uniform an angular clearance as possible. If this is not done (Fig. 9, View X) the punch has a tendency to bend toward the side having the greatest angular clearance (smallest cutting angle) and chipping of cutting edges is the result.

Align the punch and die-plate carefully, especially when the tools have a deep hardness penetration. Misalignment causes nonuniform punch clearance which is analogous to the previous case (Fig. 9, View X).

Before machining the die-plate, remove the decarburized outer portion of the steel stock; about 0.040 inch for small sections and up to 0.080 inch for larger ones.

Avoid tool marks. They cause increased stresses during hardening.

Grind the die-plate as soon as possible after the tempering.

### *Correct Grinding*

Die-plates are ground before assembling the press tool to eliminate possible surface irregularities and to bring them to size. They are also ground to restore the keenness of the cutting edges when they become dull. It is important that these operations be effected by an abrasive wheel of the proper type, grain size, grade, structure, and bond, using the recommended peripheral speed, depth of cut, feed, and coolant for the tool steel and die-plate to be ground.

The grinding of hardened die-plates is a rather delicate operation. This is due to the fact that high localized heating is produced which cannot easily be dissipated because of the low thermal conductivity of alloy steels. The greater the alloying of the steel, the more difficult the grinding. High surface stresses created by excessive localized heating can readily produce small cracks.

The most common errors in grinding of die-plates are as follows:

1. Too rapid removal of metal;
2. Use of dull, loaded wheels;
3. Use of wheels having too fine a grit;
4. Faulty use of the cooling lubricant.

### *Use of the Tool*

A tool correctly designed and manufactured may fail in service if operations with it are not properly performed. There are many common errors in press selection, in die setting, in performing operations, and in tool maintenance which may, and do, cause die-plate failures.

First, the press must be of ample capacity. This prevents misalignment of the tool due to flexing of the press body under load. The ram must be correctly adjusted in the press ways to insure punch alignment. In the case of tools mounted in die sets, the guide pins and bushings must be in perfect condition.

The contribution of the toolsetter in extending the life of a die-plate is considerable. Parallels are often placed under the die-plate (Fig. 9, View Y) in order to lift the tool. These must have ample width and should be located as near as possible to the clearance holes of the blanking openings to obtain the greatest support for the die and prevent sagging of the die-plate. If parallels are set too far apart, the die-plate is apt to bend under the cutting action, thus decreasing the punch clearance. Consequently there is a definite increase in the required cutting pressure, which in turn causes further bending of the die-plate with further decreasing of the punch clearance. Such phenomena often result in great overloads and die failures.

When dies are not mounted in die sets, an important task for the diesetter is to insure perfect alignment of the punch and the die opening. Improper setting of the punch and die-plate is exaggerated in Fig. 9, Views X and Z. If either of these two conditions exists, unsatisfactory work is produced and the tool is quickly ruined.

Punches need not pass through the stock in order to cut blanks. The punchings are severed after only a certain percentage of the stock is penetrated by the punch. Blanking and piercing punches should, therefore, enter their respective die openings only an amount that permits the shortest one to properly complete its operation. New dies or tools which have been substantially repaired or serviced should be tried out on cardboard or aluminum sheet before use.

During the operation of a tool the following details may directly or indirectly cause die-plate failures:

Every cutting die has a fixed punch clearance that is necessary for a given stock of determined thickness. It should not be employed for a material which requires a different punch clearance.

Inaccurate feeding causing the cutting of half-

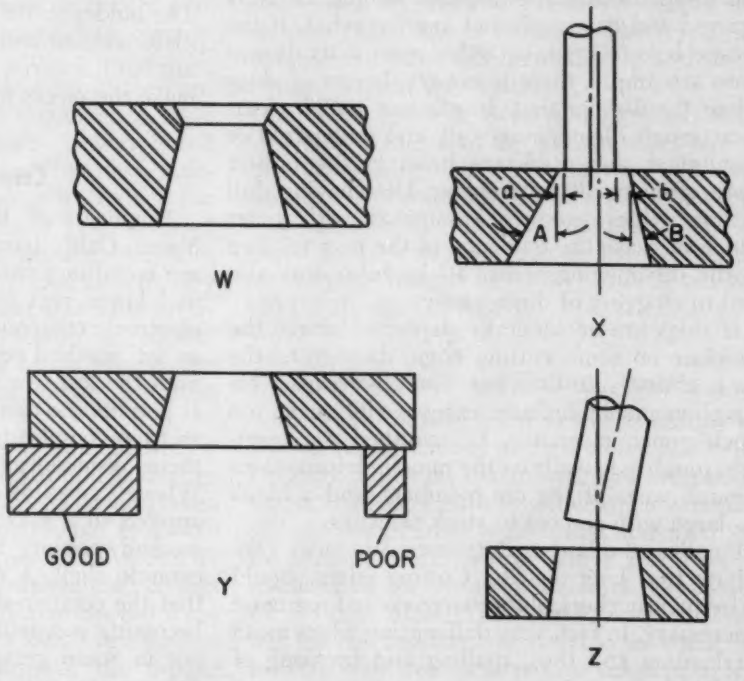



**Fig. 9. Bellmouthed die openings, View W; non-uniform punch clearance, View X; misaligned punches, Views X and Z; and improper support, View Y, often result in the failure of a die-plate.**

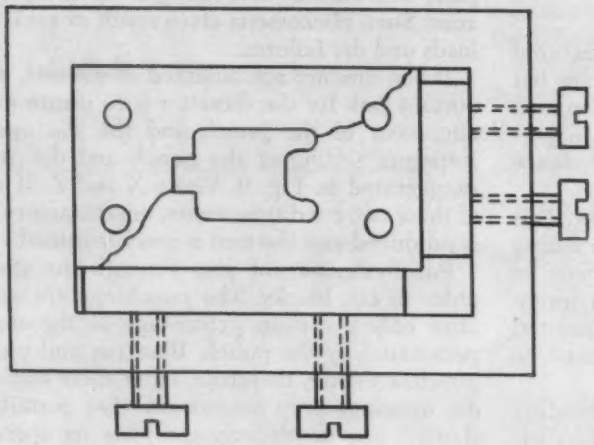


Fig. 10. A broken die-plate can sometimes be secured in a special holder and used. This method is not possible where chipping or splintering of the cutting edges has occurred.

blanks or half-holes may result in the deflection of punches and the chipping of cutting edges. Two strips, fed simultaneously, greatly overload the die. Similarly, two blanks to be punched in second operation dies may stick together if too heavy a lubricant has been employed for the blanking.

In the punching of small holes, slugs often clog the clearance holes, resulting in punch breakage and damage to the die-plate. There are several causes for this trouble. The clearance hole in both the die-plate and the die-shoe should be fully tapered and have sufficient angular relief. If the escape hole has parallel sides, even if its dimensions are ample, there is always danger of slugs filling the die opening. Insufficient punch clearance, rough die-opening wall, and undersized or misaligned slug discharge holes in the bolster plate often result in clogging. Dies having dull cutting edges produce stampings with burrs which increase the tendency of the part to cling to the die-opening walls. Sticky lubricants also lead to clogging of die openings.

If slugs are accidentally deposited above the die-plate on some cutting edge, damage to the die is almost sure to occur. The chief causes for this phenomenon include: excessive lubricant, too much punch clearance, bellmouthed die openings, rough side walls on the punch, deformations through wear of the die members, and a blank too large with respect to stock thickness.

Finally, standard maintenance practices contribute to a long die life. Cutting edges should be frequently checked for sharpness and reground if necessary. In fact, very dull cutting edges mean overloading and thus, spalling and breaking of the die-plate.

### *Emergency Repairs*

The scrapping of a broken die-plate is not always necessary, but depends upon the circumstances. If the die-plate is split in two (or for that matter, into a few parts) without splinters or chips in the zone of the cutting edges, repair is often a simple matter. A die-plate salvaged by preparing a strong die-holder made of tough machinery steel is shown in Fig. 10. The two parts of the broken die-plate have been encased and properly clamped, producing a real sectional die. The holder is machined to enclose both the die-plate sections and two shimming blocks. Clamping bolts, secured in threaded holes in the block, make the pieces immovable.

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## Ceramic-Shell Casting

Engineers of the Mercast Corporation, La-Verne, Calif., have perfected a method of casting metal in a ceramic shell. Faster casting time and lower cost for many aircraft, missile, and electronic components are claimed. This "Ceramercast" method combines the best techniques of both the lost-wax and frozen-mercury processes. It permits the casting of configurations too large and too complicated for lost-wax molds, making them economically and technically practical. Where a mass of ceramic matter has had to be applied to a wax pattern in the past, the new method permits the use of a relatively thin ceramic shell. A company spokesman contends that the ceramic-shell casting method already is becoming competitive with forging and machining in some areas, and has commercial, non-defense uses with a variety of metals.

# Replacement Analysis Accounts for Spiraling Wage Rates and Equipment Prices

IF A DECISION is made to defer the replacement of a machine tool or other piece of capital equipment for a year or more, how much more money will the prospective buyer eventually have to pay for it? The answer can be found by applying Jones & Lamson's new replacement "formula," which projects the inflationary pattern of the past to show how avoidable costs mushroom from year to year.

From indices of the United States Department of Labor—Bureau of Labor Statistics, two conclusions can be drawn: (1) Wage rates have increased in excess of 5 per cent annually over the past several years, and (2) the selling prices on metalworking machinery have risen during the same period between 6 and 7 per cent annually. Thus, it is unrealistic to apply the unweighted current wage rate on an old machine or the unweighted current selling price of a new machine in estimating costs when the decision to replace equipment is postponed.

An example out of Jones & Lamson's own experience shows the impact of the inflationary spiral. The company had been using a radial drill purchased in 1941 at a cost of $8000. Many operations, it was felt, could be more efficiently performed on a horizontal drilling machine already in the shop after a "retrofit" with a numerical-control system and a new table. Cost of the conversion was estimated to be $50,000.

In comparing operating costs, it was found that the new equipment, requiring less manpower, would at the prevailing rates reduce the cost of direct labor by $6025 per year. Indirect labor (supervision, helpers, inspection, etc.) also would be cut by $1670, and fringe benefits, by $1230. Since the new equipment was more error-free, spoilage in manufacture would be reduced by $2000. The biggest saving of all—elimination of drill jigs—was estimated to amount to $8000 yearly.

Even when the added costs of maintenance on the new equipment ($400), taxes and insurance ($1100), and depreciation ($3335) were taken into account, there still appeared to be "avoidable costs," or savings, of $14,090 per year. With a 52 per cent federal income tax deduction, savings came to $6763. This last figure represented a net return of 13.5 per cent on a $50,000 investment. Under a previously used formula, the project might have been abandoned at this point, since the return fell short of management's objective of 15 per cent.

When spiraling rates the company would have to pay out both in direct and indirect labor and fringe benefits on the old radial drill were projected over five- and ten-year periods, as was the anticipated higher cost of retrofitting, the need for immediate replacement became obvious. For example, if after continuing to use the old equipment another year, replacement was deferred for five years more, avoidable costs would skyrocket from $14,090 to $107,433. The avoidable costs of $70,450 ($14,090×5) would have to be amended upward by a projected increase in labor of $3893 and an increase in new equipment cost of $19,000, or a total of $107,433, according to the Bureau of Labor Statistics' indices. Likewise, in ten years, the projection would raise the avoidable costs from $14,090 to $202,003.

Whereas, after one year the ratio of avoidable costs to the proposed investment in new equipment was 28.2 per cent ($14,090 to $50,000), postponing the replacement an additional five years would raise the ratio to 214.9 per cent ($107,433 to $50,000), and postponing the replacement an additional ten years would raise the ratio to 404.0 per cent ($202,003 to $50,000). The result: The replacement was made immediately and the inflationary spiral was beaten.

Actually, Jones & Lamson's approach was a conservative one. Had the BLS statistics on wage rates been added to show the true *cumulative* increases over the years, the case for replacement would have been even more convincing. The projected increase in labor cost in five years would be $11,299 (instead of $3893) and in ten years $45,187 (instead of $8863).

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### New Vacuum "Plating" Process

Successful development in the laboratory of a new vacuum "plating" process which will deposit a tightly adherent, decorative, and corrosion-resistant coating of pure aluminum on a wide range of base metals from high-tensile and mild steels to aluminum die-casting alloys has been announced by the National Research Corporation, Cambridge, Mass. The ductile, nonporous coating can be anodized to provide excellent wear resistance as well as attractive coloring in a full spectrum of metallic pastel and dark shades.

# Cecostamps Form Complicated DC-8 Hot Parts



Fig. 1. Stainless-steel suppressor for Douglas DC-8 jetliner being given a visual inspection before passivation and sand-blasting operations.

JETLINERS built by the Douglas Aircraft Co., Inc., Santa Monica, Calif., are fitted with jet-noise suppressors and thrust brakes on each engine. The suppressor keeps the engine noise at an acceptable level and the thrust brake reduces the rolling run of the airplane. Reduced speed at landing shortens the run, lessens wheel-brake maintenance, and improves the aircraft performance when landing on wet or icy runways.

The complete suppressor and thrust-brake assembly contains and channels the hot exhaust gases of the jetliner. This means that the assembly must withstand severe temperature and pressure conditions in operation. Maximum gas temperatures at take-off approach 1000 degrees F.

The triple-bubble design of the suppressor is of all-welded construction and, as will be apparent from Fig. 1, has made the manufacturing job far from an easy one. All of the sheet-metal parts in the weldment must first be formed to close tolerances. The forming of the 19-9DL stainless-steel parts for the suppressor is done on Cecostamp hammers. In Fig. 2, one of the suppressor parts has been formed under a 5-ton Cecostamp.

The highly stressed structural parts of the ejector, which houses the thrust brake, are made of 17-7PH stainless steel. These parts are formed and then heat-treated in two stages. The remaining parts for the suppressor and thrust-brake assemblies are made from 19-9DL stainless steel. Fig. 3 shows a multiple-cavity die on a 3-ton Cecostamp used in performing six different operations on one part.



Fig. 2. One of the suppressor parts of 19-9DL stainless steel that is formed under a 5-ton Cecostamp hammer for application on Douglas jetliners.



Fig. 3. Multiple-cavity die used on a 3-ton Cecostamp for performing six successive operations on the one part.

After forming, most parts are trimmed and small sub-assemblies are built up by hand welding. These sub-assemblies are then gathered in the basic-structure assembly jig shown in Fig. 4 and the structure is completed by hand welding. At this point the suppressor is passivated and lightly sand-blasted for appearance's sake.

The passivating operation consists of dipping the part into an acid pickle. Two purposes are served. Any part formed by hammering is very likely to have lead or Kirksite particles adhering to it that were picked up from dies. The acid pickle cleanses the work surface of all impurities and, secondly, makes the surfaces of the stainless steel less susceptible to discoloration from air contamination. Chemically, passivation removes "solution potential," which means that the passivated surface is not an active combiner.

Each suppressor is finally Zyglo-inspected before assembly on the airplane. In Fig. 1 an inspector is visually checking an assembly prior to the passivating and sand-blasting operations.



Fig. 4. The stainless-steel components of suppressor assemblies are hand-welded together on a basic-structure assembly jig as here shown.

# MATERIALS

**The properties and new applications of materials used in the mechanical industries**

### Cast Aluminum Alloy for Automotive Pistons

An aluminum-base alloy containing 0.10 per cent vanadium, 22 per cent silicon, and 2.25 per cent nickel is being used to produce engine pistons. The alloy, called "Vanasil," is made available by Gillett & Eaton, Inc., Lake City, Minn. It has a coefficient of expansion only two millionths of an inch per inch more than cast iron, which provides for a close-fit piston installation and good compression. Pistons of this alloy are cast in sizes as small as 7/8-inch diameter suitable for refrigeration compressors and also in 6 7/8-inch diameter for heavy-duty engines.

### Epoxy Resin for Structural and Insulating Purposes

A resin, called "Epocast 28," when used in conjunction with "Hardener 9012," both produced by Furane Plastics, Inc., 4516 Brazil St., Los Angeles 39, Calif., is said to form a good structural resin, particularly suited to the laminating of glass fibers. The resin and its hardener meet military requirements, and have a very long pot life and good impregnating qualities. They also have a relatively short cure at moderate temperatures, good electrical properties, and a low dielectric constant when compared to other epoxy resins. The resin has been used for structural laminations and for electrical insulating purposes.

### Spring Wire for Temperatures Up to 1400 Degrees F.

A precipitation-hardened, super-alloy cobalt wire has been announced by National-Standard Co., Niles, Mich., for forming springs designed to operate at temperatures from 400 to 1400 degrees F. Designated "Alloy HS25," it has the following percentage composition: cobalt, 46 to 53 per cent; chromium, 19 to 21 per cent; tungsten, 14 to 16 per cent; nickel, 9 to 11 per cent; and carbon, 0.05 to 0.15 per cent.

Although the wire is available annealed up to 35 per cent reduction, a wire drawn to 30 per cent reduction is available in a size range from 0.018- to 0.171-inch diameter and has a tensile strength of 200,000 to 240,000 psi and an elongation range from 4 to 8 per cent. This spring material is supplied for automatic coiling with a gray-oxide finish that can be removed by nitric acid, tumbling, vapor blasting, or similar methods. The material is nonmagnetic.

### Silver Brazing Flux with Good Heat Tolerance and Coverage

A silver brazing flux with good heat tolerance and good coverage per pound of material has been made available by Special Chemicals Corporation, 100 South Water St., Ossining, N. Y. Called "Kwikflux 490," it has the ability to remain in solution and retain its strength when diluted with relatively large volumes of water. It has a smooth consistency for ease of application which makes it particularly adaptable to automatic or semi-automatic brazing operations. The material may be used in a brazing temperature range of from 1100 to 1700 degrees F.

### Rust Preventive for Barrel Finishing and Wet-Blasting

Four rust-preventive additives and compounds, called "Anarust," have been introduced by Techline Division, Wheelabrator Corporation, 2400 Avenue V, Vicksburg, Mich. Types "B" and "G" are used principally in wet-blasting abrasive slurry. They are additives and leave a film on parts being cleaned that prevent oxidation. These additives are so formulated that plating or painting of the parts may be accomplished without degreasing or chemical washing. Type "B" is commonly used in finishing ferrous metals, whereas Type "G" is used to clean certain types of aluminum.

The other two, called Type "D" and Type "S," are compounds used after the cleaning and finishing process and are applicable equally in barrel-finishing and wet-blasting operations. Type

"D" is a water-displacing dip used after processing. This is usually applied to parts that are finished in batches. It is removed by washing with an alkaline before plating or painting.

Type "S" is a water absorbing compound that coats the object to be protected. It is applied by spraying, and is used on machinery that may stand idle for protracted periods and on parts and equipment exposed to outside-storage corrosion. This type, too, must be washed in an alkaline solution before painting or plating.

### Easily Manipulatable, Lightweight Seamless Aluminum Tube in Coil Form

A general-purpose seamless aluminum tube produced in many diameters and wall thicknesses has been made available by Chase Brass & Copper Co., Waterbury 20, Conn. This tube has many applications in appliances, refrigeration and automotive work, and similar technical and industrial uses where a light, strong, easily handled tube is necessary.

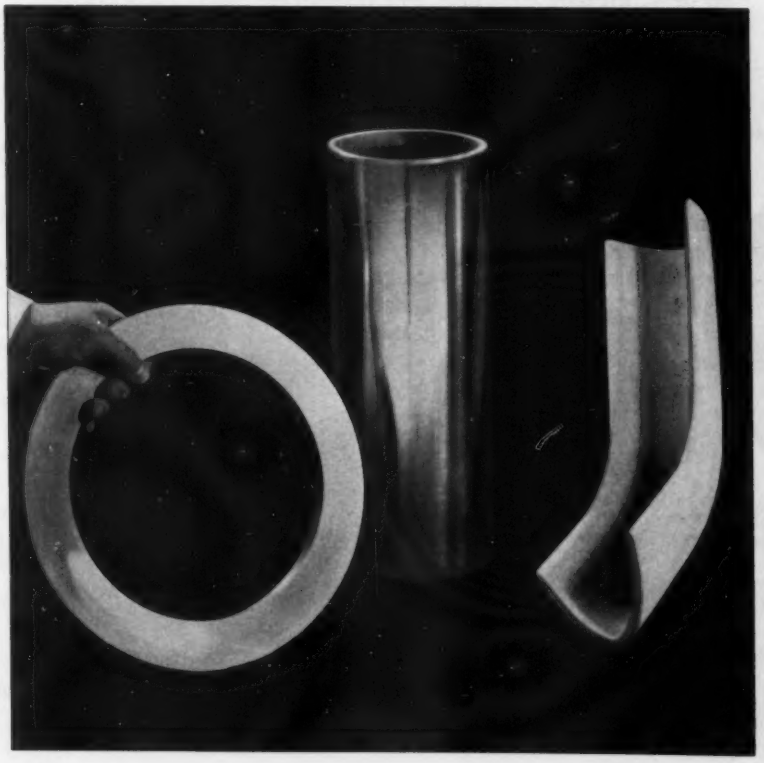
Called "Chase General Purpose Seamless Aluminum Tube," it is made from a soft-temper 3003 aluminum alloy. It flares easily, by either manual or mechanical means, and uncoils readily for cutting or straightening. Sizes range from 1/8-inch OD with a wall thickness of 0.025 inch having a safe bursting pressure, according to the American Standard Code of Pressure Piping, of 1066 psi to 3/4-inch OD with wall thickness of 0.049 inch having a bursting pressure of 348 psi.

### Chemical for Removing Grease and Oil Stains from Concrete

"BanZoil," a chemical that removes grease and oil stains from driveways, garage floors, sidewalks and other concrete or brick surfaces, has been announced by the Banzoil Co., 54 E. Delaware St., Chicago, Ill. A noncaustic cleaner, it is said to penetrate into stained concrete or brick and float out the grease, oil, and petroleum products in about sixty seconds so that they may be wiped up with a cloth. The product is said to be harmless to painted surfaces.

### Epoxy Adhesives Marketed Expressly for Strain-Gage Application

Two epoxy cements, formulated specifically for use with bonded-filament strain gages, have been announced by the Electronics & Instrumentation Division of Baldwin-Lima-Hamilton Corporation, 42 Fourth Ave., Waltham 54, Mass. Designated "EPY-150" and "EPY-400," these adhesives have a maximum service temperature of 150 degrees F. and 400 degrees F., respectively. Both types are furnished in small plastic packs, each divided into two compartments, one containing the liquid



**"Cormet A," a porous sintered nickel material produced by Corning Glass Works, Corning, N. Y., can be made into a variety of shapes as can be seen by the polished burner ring at the left, the roller at the center, and the unpolished chute at the right. The material can be used as a noncontacting conveyor by having the products being processed "ride" on a thin cushion of air forced through the pores of the sintered nickel material.**

adhesive and the other, the activator. The cement is mixed for use by simply removing the split metal pin which divides the pack and then kneading with the fingers. Shelf life is six months or more.

### Water-Displacing Rust Preventive for Long-Term Indoor Storage

The protection of metal parts to be stored indoors for long periods can now be effectively accomplished by use of "Rust Veto 377," made available by E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa. It may be applied to wet metal surfaces and acts by "creeping" under surface moisture, coating the metal with a 0.0003-inch, oxidation-protective film. This film is not removed by ordinary handling, and treated parts do not have to be cleaned before lubricating because the preventive is compatible with ordinary mineral lubricating oils.

### Long-Term Protection for Metal Surfaces Chemically Provided

Long-term protection for metal surfaces is being provided by "CRC 3-36," a chemical made available by Corrosion Reaction Consultants, 116 Chestnut St., Philadelphia 6, Pa. The chemical is equally effective on iron, steel, aluminum, magnesium, and plated finishes and also helps to eliminate verdigris on copper and brass. Duration of effectiveness depends upon individual conditions of use and exposure. It never becomes dry, hard, or brittle and is harmless to paint and organic finishes, plastics, rubber, and humans.

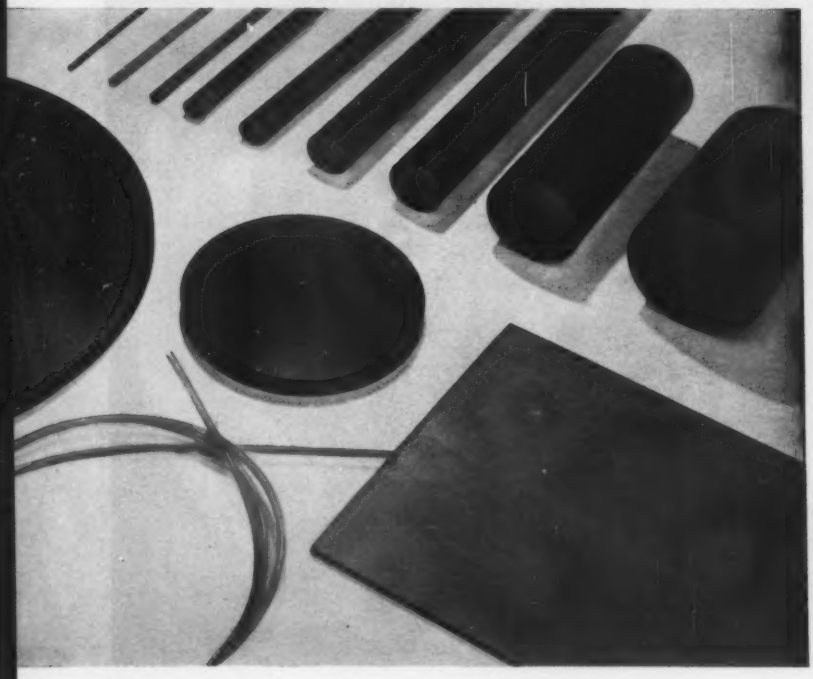
The chemical may be applied by spray, brush, or immersion and is suitable for use on precision equipment and sub-assemblies as well as machined surfaces, castings, and raw material stocks. It does not have to be removed before assembly operations or use.

### Blue Nondrying Steel-Marking Coating for Die Spotting

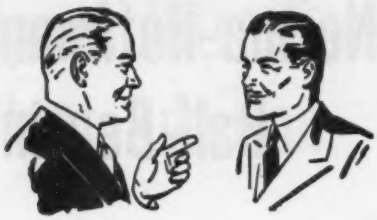
A product which replaces Prussian blue for spotting dies, punches, and round and flat bearing surfaces has been announced by Wayne Chemical Products Co., 9250 Copland Ave., Detroit 17, Mich. Called "Kemifilm #27," it is a blue steel-marking coating which will remain moist on metal. It is water soluble and can be easily removed from clothing, skin, metal, and tools with water. It is nonflammable and nontoxic.

### Drawing Lubricant for Hot-Forming of Sheet Metal

A drawing lubricant for hot-forming of sheet metal such as titanium has been developed by EverLube Corporation, 6940 Farmdale Ave., North Hollywood, Calif. "EverLube T-50," as it is called, is applied to the sheet and allowed to dry. After forming it may be removed with a hot caustic dip or solvent cleaning.



**Mill shapes of Lexan, a polycarbonate resin developed by the General Electric Co., have been introduced by the Polymer Corporation of Pennsylvania, 2140 Fairmont Ave., Reading, Pa. Called "Polypenco," the forms produced include rod, tubing, plate, and discs that can be fabricated into close-tolerance finished parts. The product has high impact strength, high heat resistance, dimensional stability, and good electrical properties. It is available in rod from 1/2 inch to 4 inches in diameter, in discs from 6 to 18 inches in diameter with thicknesses of 1/4 to 2 inches, and in plate 1/4 inch to 1 1/2 inches thick. Flexible mechanical tubing of the plastic is also made.**



# Talking With Sales Managers

By BERNARD LESTER
Management Consulting Engineer

## Don't Let Good Men Quit

THE TOPNOTCH SALES MANAGER not only has the ability to develop sales engineers, but usually can hold on to the good ones. A good sales engineer can be easily underrated, and a poor one overrated. The worth of the good man has climbed steadily as the cost of sales tools, supervision, and other indirect expenses have gone up. A good salesman is an increasing asset; a poor one an increasing expense.

Changes in our industrial climate have increased restlessness among sales personnel as well as among other employes. Most frequently we see instances where the engineering graduate is dissatisfied with his job within a year or so after being hired. With the shortage of technically trained men, there has been a tendency for the employer to oversell the merits of the job. Likewise, with the pressure of work, there exists a tendency to overlook the importance of getting the cadet to understand and appreciate the advantages of exact and unbroken preparation for sales engineering.

Studies of how to hold on to the inexperienced as well as the mature sales engineers invariably are concerned with reasons for quitting. Such studies deserve more than ordinary scrutiny, for the returns from a questionnaire can be misleading. In answering specific questions, the respondent is inclined to seize the ready and simple answer, not always revealing the true cause for dissatisfaction, which may be more profound, and difficult to express.

Employes' chief dissatisfactions in the past have been expressed largely in terms of low wages and long working hours. These objections were easy to understand. But Elton Mayo came along to show us from his studies that social motivations make for greater production even than the size of the hourly pay check. He proved that a recognition of accomplishment actually came first.

The most common monetary reasons why salesmen quit are:

1. Dissatisfaction with amount of total compensation.
2. Territory curtailed or sales quota raised.
3. Lack of incentive bonus.
4. Inequality of reward for similar accomplishment by other members of the sales force.

On the contrary, the following causes of separation are not directly financial:

1. Little chance of advancement.
2. Inferior, often obsolete equipment to be sold.
3. Insecurity of position.
4. Poor corporate business policies—vacillation, shortsightedness, or nepotism.
5. Sales leadership missing or weak.
6. Working conditions unhealthy: excessive travel, office work, routine, or red tape.

Of course, each of these objections is subject to individual interpretation. Each begins as a seed, which sprouts and grows. So too do misconceptions and misunderstandings, which thrive in the environment of neglect. If allowed to grow in the mind of the sales engineer, in time they make him want to leave.

Supervision may well have fallen short when the sales engineer steps into your office without warning and says he wants to quit. The most proficient sales manager today defines objectives. But what is even more, he provides suitable ground and the sort of tillage which allows good seeds to grow. He studies personal traits. He gets inside the minds and hearts of men and finds out what makes them tick.

One sales manager, in naming his four top sales engineers, has this to say: "These men may not be the very best in the world, but they are better than I could hire from the outside if I tried for a year." How does he keep them?

"By discovering," he contends. "Discovering something about them all the time, and asking myself what I would do in their place. To do this, you must know them, and above all, understand how they feel. By the way, one of them in some years has made more money than I have. I am awfully happy he did."

Very few good men quit "suddenly." The underlying causes are those which should invariably concern us.

# Norma-Hoffmann Ball-Bearing



Honing of inner and outer raceways provides a finer surface finish that reduces noise level and assures low starting and running torque. Equipment has four heads, handling two inner and two outer races simultaneously. All bearings are honed, even though not required by ABEC-7 specifications.

ANGULAR-CONTACT ball bearings are now being manufactured to ABEC-7 tolerances or better in a new facility at the Norma-Hoffmann Bearings Corporation, Stamford, Conn. Such bearings are in demand for modern machine tools, aircraft auxiliaries, woodworking machinery, computers, memory devices, high-speed gear trains, and similar applications involving speeds in excess of 50,000 rpm where extreme precision and maximum rigidity are mandatory.

Among the unique or unusual practices instituted are pre-load grinding techniques with in-process gaging; honing on company-developed equipment to a lower micro-inch finish than has been possible previously; single-cycle rough and finish internal grinding; deep freezing of stock following hardening, to assure dimensional stability; and control of grinding coolant temperature to within 2 degrees of room temperature (with impurities as small as 3 microns removed) to minimize thermal expansion of the work and thus allow immediate gaging.

The facility is separated from the main Norma-Hoffmann plant with an air-lock anteroom where



This shoe type centerless grinder finishes the inside diameters of inner and outer races. Larger work is held against the rotating backing plate without distortion by a hydraulic clamping device. All internal grinders have automatic chute loading and unloading devices.

# Opens Ultra-Precision Plant Addition

entering personnel can wash and don lint-free coats. Incoming air is thoroughly filtered, with temperature being held to within 1 degree of 70 degrees F., and relative humidity, to within 40 to 50 per cent.

After heating in a rotary controlled-atmosphere furnace, followed by press quenching, parts are given a hot alkali wash and moved to the deep-freeze unit where temperature is dropped to minus 120 degrees F. They are then brought up to room temperature and drawn at 360 to 400 degrees F. The deep freezing inhibits the metal's tendency to grow in subsequent processing and application. It also helps maintain the raceway hardness.

The pre-load grinding technique was developed by the company. In the operation, end faces of matched pairs of inner and outer races are ground so that when the assembled bearing is compressed to its normal mounting position, the balls will be subjected to the desired pre-load pressure as the faces of both races are drawn up flush. After a pair is selectively assembled with a master set of balls, it is pre-loaded and special testing equipment measures the amount of stock to be ground off the faces. Then, when disassembled, the races go to rotary surface grinders, where in-process air gages register the height of the face above the chuck at each cycle of the table movement.



**Finish pre-load grinding is performed on rotary surface grinders equipped with in-process air gaging to control height of bearing face above chuck. A large dial indicator on which the reading appears is interlocked with the feed mechanism to prevent over-grinding once size has been reached.**



**A high-frequency induction heater expands the outer ring momentarily, allowing the inner ring, balls, and retainer ring assembly to drop into place. In order to have high radial load capacity a large number of balls are required. Because of this, the usual method for assembling the ball-bearing components cannot be followed.**

# LATEST DEVELOPMENTS

**Machine tools, unit mechanisms, machine parts, and**

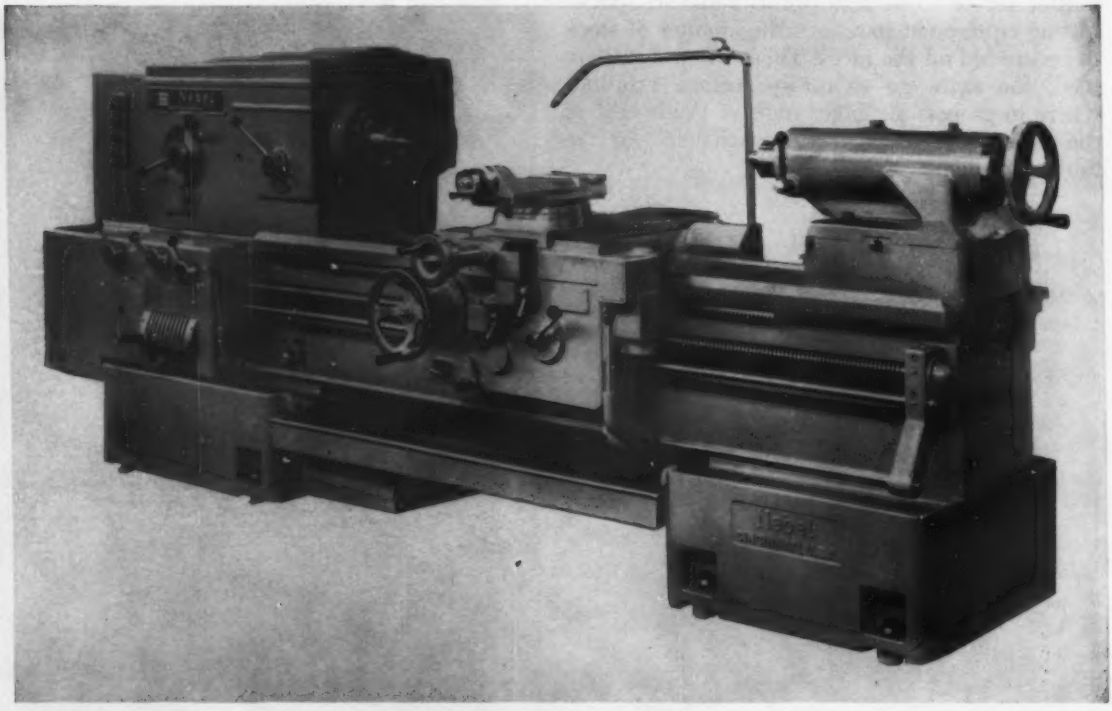
## Nebel Heavy-Duty Engine Lathe Built for Precision Work

The Nebel Machine Tool Corporation, Cincinnati, Ohio, has announced a heavy-duty engine lathe known as Model HD 2516. This machine, said to be of an entirely new, proved design, has more and higher spindle speeds than any Nebel lathe previously available. It is especially designed to handle a wide variety of heavy work that requires precision turning and facing operations. Any one of its eighteen available gear-driven speeds can be easily selected from a direct-reading color index. These speeds are easily controlled by two levers and color-keyed speed plates. Speeds up to 1500 rpm are available through a gear arrangement which engages only the gears required to obtain the speed selected. The heavy-duty headstock has wide-faced, shaved, and hardened gears. These gears have short, heavy, multiple-splined shafts with antifriction bearings.

The front and center bearings of the rugged three-bearing spindle are of the zero-precision, angular, tapered-roller type, preloaded and adjusted for maximum radial and thrust loads. The third or rear bearing is of the radial type with provision for longitudinal spindle expansion. The spindle itself is an alloy-steel forging that is completely ground and has a hardened nose.

The heavy-duty, quick-change gear-box provides sixty different feeds ranging from 0.0027 to 0.192 inch per revolution of the spindle. There are sixty thread changes from 1 to 72 threads per inch, including standard pipe threads, all selected from a direct-reading index-plate. The machine is built to ASA standards and tolerances of accuracy for engine lathes. Up to 20 hp is supplied by a constant-speed, main-drive motor. The drive is through a multiple-disc clutch-and-brake unit mounted externally on the headstock to facilitate maintenance and adjustment.

Inserted bedways of hardened and ground steel are provided on the front "V" bedway and the rear flat bedway. Heavy-duty design is evident in the extra-wide carriage, which has 146 square inches of bearing surface on the bedways for the distribution of the thrust load or forces imposed on the cutting tool. The broad carriage bridge also provides additional



Heavy-duty engine lathe designed for precision work announced by the Nebel Machine Tool Corporation

# IN SHOP EQUIPMENT

**material-handling appliances recently introduced**

Edited by FREEMAN C. DUSTON

tool support. The carriage is secured to the lathe bed when performing facing operations by gibs at both the front and rear bedways. There is also a locking bolt on the front ways. Cross-slide and compound-rest gibs located on the operator's side of the lathe take the full thrust of the tool against the solid side of the dovetailed bearing surfaces. The hardened cross- and compound-feed feed-screws and the compensating type anti-backlash cross-feed nut are designed to assure long life and accuracy.

A double-wall, one-piece cast apron of heavy-duty design provides rigid support for the inboard and outboard bearings of all rotating members. Gears are designed and heat-treated to meet full-load requirements and their shafts have antifriction bearings. The drive for the two-way, longitudinal power rapid-traverse movements is provided by an individual motor, mounted on the apron.

The heavy-duty tailstock, with its large-diameter spindle, can be power-traversed by the regular longitudinal feed mechanism. This is done by simply engaging the carriage and tailstock through an interlock. A heavy-duty thrust lock, which engages a rack located in the bed, prevents the tailstock from moving on the bedways when it is under a heavy load.

Automatic lubrication is provided for the headstock, quick-change gear-box, and apron. An externally mounted pump-and-motor unit supplies pressure lubrication to all headstock bearings and an automatic oil spray to all rotating parts. A cascade oil system serves to lubricate the quick-change gear-box. The end gearing is totally enclosed in a self-lubricating housing. All apron gears are lubricated from an oil reservoir. A one-shot system lubricates carriage ways, cross-slide, and bedways.

Circle Item 565 on postcard, page 215

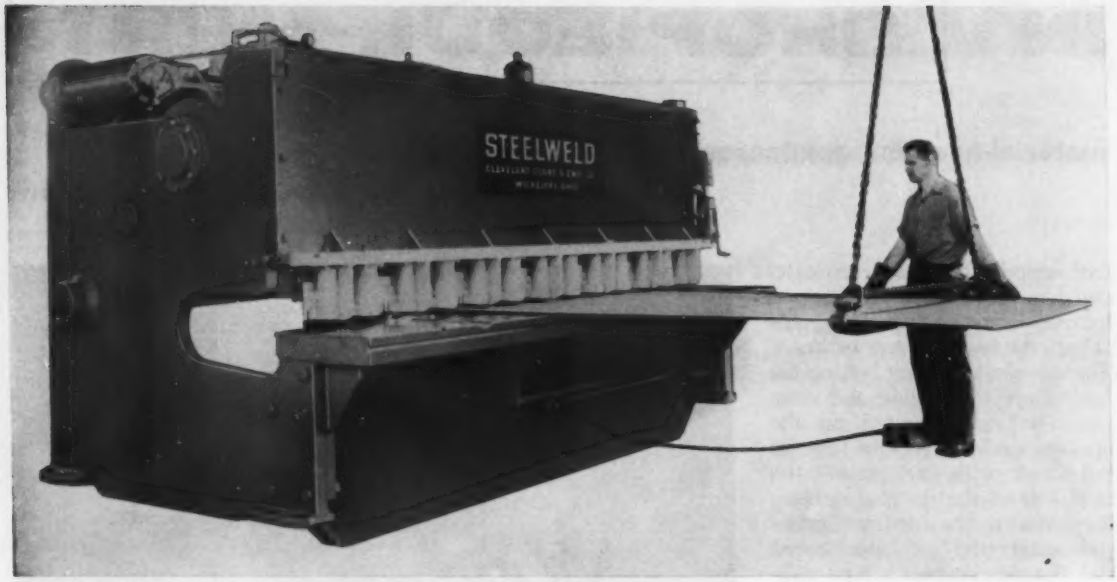


Sundstrand precision drilling, boring, reaming, and tapping machine

## Multiple-Spindle Drilling and Boring Machine

A precision multiple-spindle drilling, boring, reaming, and tapping machine designed for processing non-ferrous metal parts is announced by Sundstrand Machine Tool, Division of Sundstrand Corporation, Belvidere, Ill. This machine is equipped with quick-change heads. No gearing is used to drive the work-spindles, which can be spaced for minimum distances between centers. The unit is being made available in two sizes with either an 18- by 36-inch head or a 9- by 14-inch head. The heads can be interchanged completely in fifteen to twenty minutes. Similar work-pieces with a few different holes can be accommodated by providing additional spindles as required.

A unique feature of these machines is the gearless spindle drive in the heads. This permits relatively low-cost head assemblies to be developed, using low-cost spindles and parts. In the event of a major change-over in the work or product, approximately 75 per cent of an obsolete head can be salvaged and applied to new jobs. Complete drill heads temporarily out of service, or portions of drill heads, can be stored in a small




Steelweld pivoted-blade hydraulic shear for cutting steel plate

space and reassembled when needed.

A standard line of tool adapters manufactured to close tolerances permits pre-setting of duplicate tools outside the machine to minimize change-over down time. Special tool adapters can be furnished when required. Outstanding accuracy is provided by the new machine which holds tolerances to 0.0002 inch for spacing relationship, shoulder depth, and hole size, depending on the size of the part, shrinkage, expansion, material composition, tool maintenance, and other variables.

Minimum center distance depends upon the size of cartridge required to handle the individual work-spindle. Four standard cartridge sizes are available: 1/4, 1/2, 3/4, and 1 inch in diameter requiring minimum center distances of 9/32, 17/32, 25/32, and 1 inch, respectively.

Feed rates of 0.005 to 0.008 ipr (inch per revolution) are available for drilling, and rough- and semi-finish-boring in aluminum and magnesium. Finish-boring in the same materials is at feed rates of 0.0005 to 0.001 ipr.

The same coolant is used to control the temperature of the head fixture and to flood the part during machining.

Circle Item 566 on postcard, page 215

## Hydraulically Operated Shears

A line of hydraulically operated metal-cutting shears has been developed by the Steelweld Machinery Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio. These shears are different from conventional hydraulic shears in two basic respects: (1) The blade is powered by a single hydraulic cylinder. (2) It is pivoted and turns or descends in a curved path. The latter has been an exclusive and outstanding feature of Steelweld mechanical shears. The single cylinder applies constant force throughout the cutting action by means of a cross shaft that links the piston rod to the two ends of the blade.

The use of one cylinder also simplifies the hydraulic circuit. This cylinder need only be of a size comparable with either of the two used on a two-cylinder machine. No special circuits are needed to keep the blade level.

The single cylinder has an important advantage in that it provides a second, higher speed for cutting lighter or thinner material. Sheets up to and including 65 per cent of the rated thickness are cut at double the down-stroke full-load speed. The hydraulic circuit automatically changes to slow-speed full-load capacity when required.

The knife clearance can be easily adjusted to suit different plate thicknesses by turning a conveniently located hand crank. This permits shearing with exactly the right clearance for every plate size. As a result, sharp, straight, accurate cuts with minimum burr are obtained. Also, the knives are said to stay sharp longer. The operator can quickly set the shear for short-stroke operation, thereby providing more rapid cycling when cutting narrow stock. Where a considerable amount of shearing is done, the limit switches can be adjusted from time to time so as to move the shearing action to different sections of the knives and thus distribute the knife wear.

Among other features are the heavy steel frame, deep 24-inch throat, quiet hydraulic hold-downs, portable fatigue-reducing electric foot switch, smooth-operating back gage, convenient one-man knife adjustments, and low, fixed rake angle. "Safety stroke," "single stroke repeat," and "single stroke nonrepeat" control cycles are available merely by turning a selector switch. Steelweld hydraulic shears are available in a complete range of sizes for cutting plate lengths up to 30 feet and for all thicknesses from light gage to 2 inches.

Circle Item 567 on postcard, page 215

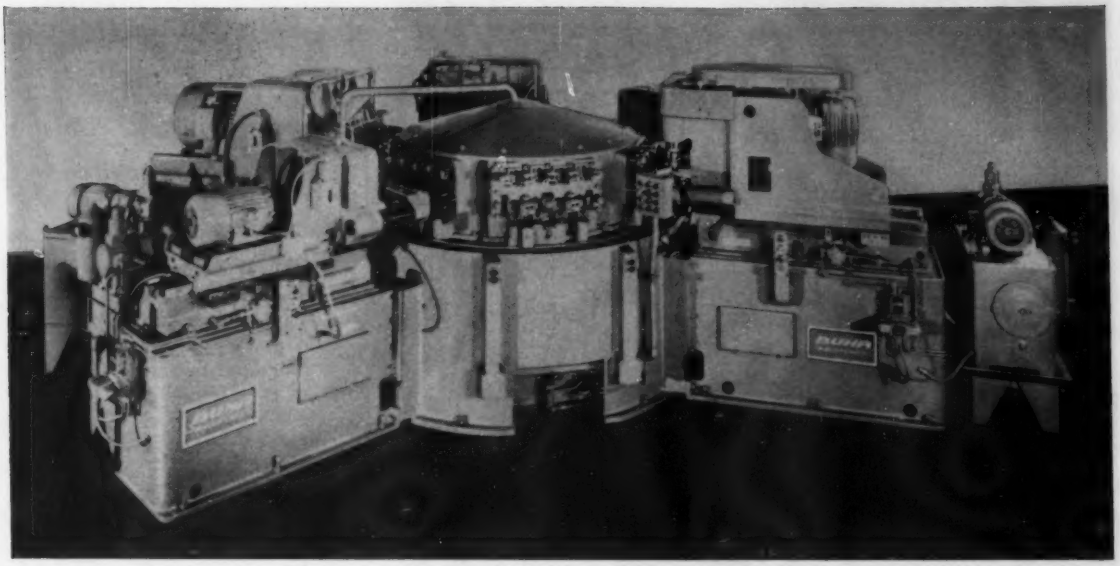


Fig. 1. Buhr five-way dial-index machine for processing truck engine connecting-rods and caps. Parts move clockwise around the dial, with the slitting saw station shown in the right foreground.

## Buhr Dial Type Machine Designed for Processing Connecting-Rods and Caps

A special machine for processing forged connecting-rods and caps for truck engines has been developed by the Buhr Machine Tool Co., Ann Arbor, Mich. This equipment features hydraulic cylinders that rotate with respect to their pressure source. Displaced boring cutters machine crankpin holes that are round after cap and rod are separated. This is an example of the kind of special machine tool that is required to be as flexible in operation as general-purpose machine tools if it is to perform its work economically. The five-way dial-index machine illustrated can be equipped with either high-speed steel or carbide tools. Initially, the machine will use high-speed steel tools to take heavy cuts and process a large number of parts per grind. It will process SAE-1141 steel forgings with a hardness rating of 212 to 241 Brinell.



Fig. 2. Forged connecting-rod blank (at left), and rod and cap set machined on Buhr Economatic shown in Fig. 1.

The machine drills, core-drills, reams, and chamfers the wrist-pin holes. It also bores the crankpin hole and then separates the cap from the rod with a slitting saw. Boring spindles for the crankpin holes are designed for speeds from 45 to 300 sfpm (surface feet per minute) and the wrist-pin-hole spindles for speeds from 45 to 120 sfpm. Change-gears are easily accessible to the setup man so that either type of tool can be operated at its optimum speed.

This Buhr Economatic is basically an index-table mounted on a central base with five hydraulic feed units radiating outward. The feed units are mounted on wing bases, bolted to the center base, and are powered by hydraulic pump-reservoir units. All major units are of the standard building-block type.

Mounted at each of the six positions on the index-table is a four-place fixture. After unloading four sets of finished rods and caps, the operator loads four one-piece forged blanks. A hydraulic cylinder retracts and allows spring-loaded locators to pull the forgings down and centrally position them. When the parts are seated, the operator shifts a four-way valve to clamp

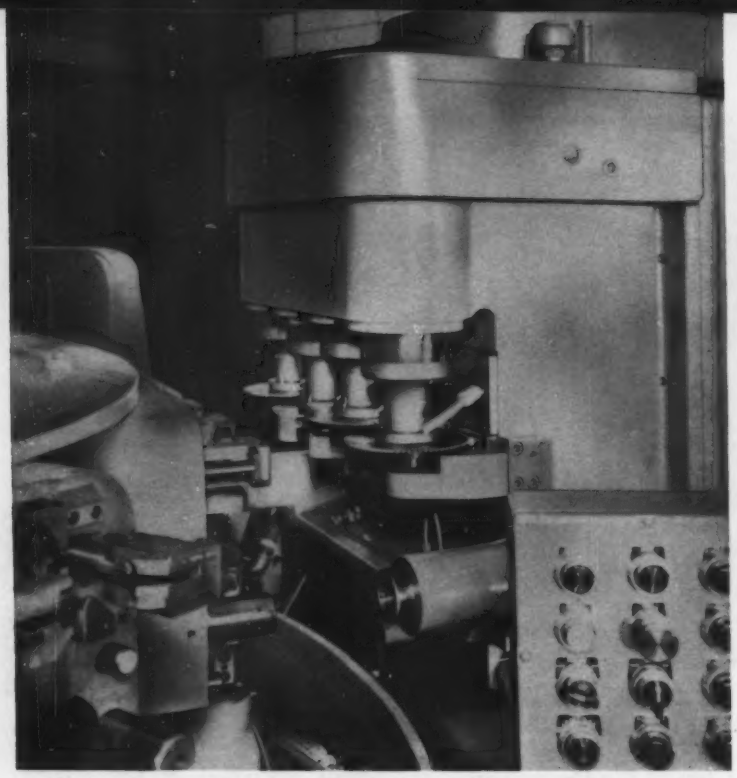


Fig. 3. At the final station of machine illustrated in Fig. 1, caps are severed from the connecting-rods by four slitting saws. These saws are located at different heights so they can overlap to save space. Parts are held in fixtures at different heights to correspond with saw locations.

them in place. Seven clamping cylinders are integral with each fixture and these must be under pressure during the complete cycle around the machine. To accomplish this, hydraulic pressure and tank lines are introduced to the rotating table from the stationary pump-reservoir unit through a grooved rotating joint at the hub of the table.

A 5/8-inch, high-speed steel drill is used for the first pass through the wrist-pin hole. This is followed by a 7/8-inch, high-speed steel drill and a 1 1/4-inch, four-flute, high-speed steel core drill. The final operations on the wrist-pin hole are performed with a combination, carbide reaming and chamfering tool. The number of steps used to open up this hole was dictated by the cycle time available and by reasonable thrust limitations. If a larger drill were used in this station, cycle time would be too high and a larger feed unit would be required. The result of these operations is a semi-finished diameter of 1.296 inches with a tolerance of plus or minus 0.001 inch, for finishing on another machine.

While the wrist-pin hole is being opened up with one set of spindles, the crankpin bore is being cut by tools on another set of spindles. The centers of the first flange-mounted, high-speed steel inserted-blade cutters are positioned above the true center of the bore by a distance equal to the thickness of the slitting saw. Similar cutters in the next station are centered on the true center of the crankpin hole. After the caps and rods have been separated by the slitting saw, they can be bolted together to form a circular bore.

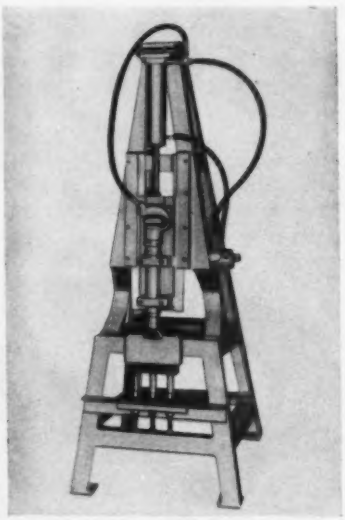
Special seventy-two-tooth high-speed steel slitting saws are used to cut the machined blank into a connecting-rod and matching cap. Fixtures that clamp the one-piece blank also hold both parts securely after the sawing operation. The parts have a thickness of 1.307 inches where they are separated by the saw cut. Saws 7 inches in diameter are used which can be re-sharpened and re-used down to a diameter of 6.50 inches. With four sets of connecting-rods and caps completed in each thirty-six-second cycle, the production rate of this machine is 300 sets per hour at 75 per cent efficiency. Production rates would be about the same if carbide tools were used but tool costs per part are lower with high-speed steel tools under the present operating conditions.

Circle Item 568 on postcard, page 215

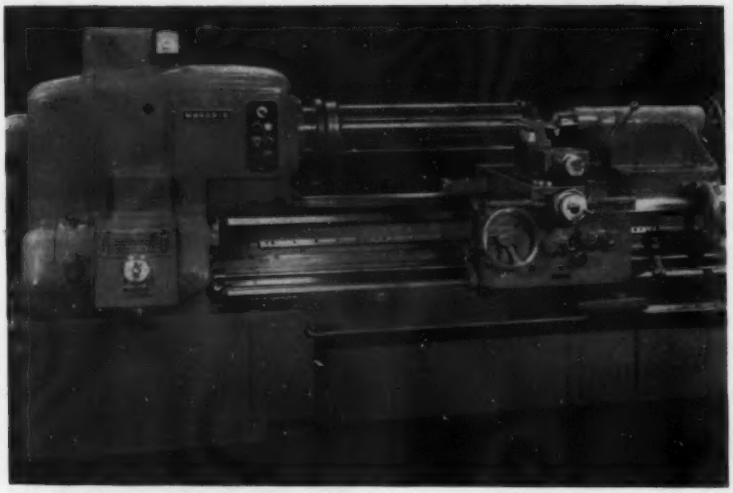
## Core-Knockout Machine

The United States Drill Head Co., Cincinnati, Ohio, has introduced a core-knockout machine for use in foundries and in plants handling sand castings. This unit, originally designed and built by the company for use in its own foundry, is particularly suited to the field of non-ferrous and light-metal casting. While its primary purpose is to facilitate the removal of core sand, the machine is also useful in cleaning off mold sand that may stick to a mold or casting. It is said to work equally well on all types of cores, including $CO_2$ and baked cores. The equipment is available either complete with air-operated, built-in hammer, or adaptable for operation by any standard air or riveting hammer connected to the shop air line. A convenient, lever-operated valve controls the head traverse. Shake-out is controlled by the trigger on the hammer. The anvil is supported on a husky spring mount in the base portion of the fabricated frame.

Circle Item 569 on postcard, page 215



Core-knockout machine brought out by United States Drill Head Co.



Turning a cylinder on a Monarch Series 62 Hy-Fin lathe to a micro-inch finish, holding the taper of the cylinder within limits of 0.00025 inch

## Monarch Lathe Designed to Machine Work to Micro-Inch Finish

A Model 2516 Series 62 Hy-Fin lathe designed to finish-turn rolls, cylinders, tubes, and like parts to a critical micro-inch finish at speeds above 2000 sfpm (surface feet per minute) has been announced by the Monarch Machine Tool Co., Sidney, Ohio. This lathe serves to eliminate or drastically reduce grinding and polishing time. Taper is held within 0.00025 inch and concentricity to less than 0.0005 inch.

The swing over the bedways is 25 inches and over the cross-slide, 16 inches. Center distance on standard machines is 72 inches but for those whose requirements demand additional length, this lathe is available in center-distance capacities of 96 and 120 inches.

Variable-speed drive direct to the spindle is through a PolyVee belt. No intermediate shafts or gears are used in the headstock to effect the surface finish of the part being turned. Variable spindle speeds can be selected over a constant torque range of 100 to 2200 rpm. All electrical controls are mounted on the front of the headstock. Spindle speeds are indicated through an electrical tachometer on the headstock.

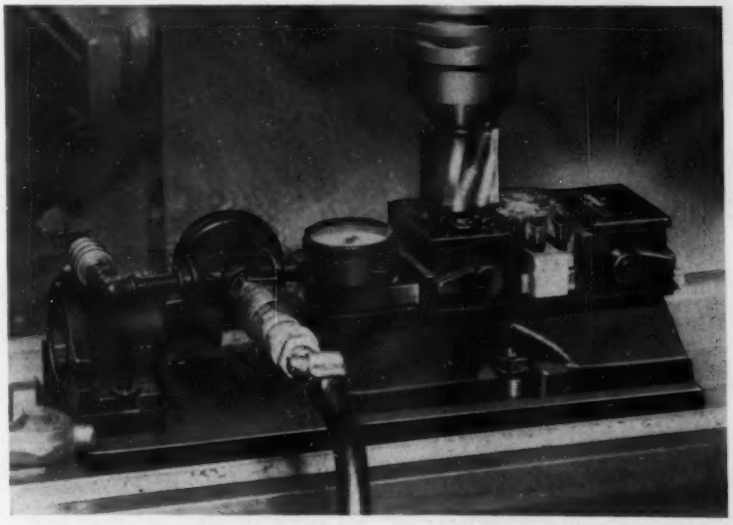
The lathe has a standard carriage and apron with four-way power traverse. Adjustment of the tool can be made in increments of 0.0001 inch through a dial indicator on the bottom slide. Bed alignment is held within 0.00025 inch in 36 inches. All bedways are flame-hardened and precision-ground. A heavy, built-in antifriction type tailstock provides the rigidity that is an important factor in producing the high finish obtained. End gearing is totally enclosed and automatically lubricated. Precision bearings in the headstock are all automatically lubricated through a centralized system.

Low-carbon steel hydraulic cylinder tubes are turned at 1500 sfpm to a 20-25 micro-inch finish. Another typical use is the diamond turning of copper-plated rotogravure cylinders to a 6-micro-inch finish. High cutting speed saves time in the turning operation and subsequent polishing time is reduced by as much as two to three and one-half hours per cylinder.

Circle Item 570 on postcard, page 215

## Bliss Contour-Grip Work-Holding Fixture

Any odd, irregular, or symmetrically shaped part can be held by a contour-grip fixture developed by the E. W. Bliss Co., Cleveland, Ohio. This fixture can be actuated pneumatically, hydraulically, or through solenoid valves, and sychronized with the operation of any machine tool. Thus it can be used to hold work for high-speed production operations. In field studies conducted by the manufacturer, it has been used as a conventional vise and as a single- or multiple-jig fixture. In one case, ten contour-grip fixtures were arranged on a grinder for a production run of dozens of different irregular-shaped pieces for which costly special fixtures would ordinarily have been used. Additional tests involved the use of millers, profilers, planers, drills, lathes, and other machine tools,



Bliss power-actuated contour-grip work-holding fixture

where the greater holding power of the contour grip served to reduce machine time by permitting faster feeds and deeper cuts. It is said to be effective on long or short production runs.

The fixture jaws are composed of movable "fingers" which actually mold themselves around the part to be held, no matter what its shape. When the jaws are backed off from the work-piece, the fingers remain in the same relative positions as when gripping the piece so that the next piece can be easily dropped into place and clamped.

If a part of a different shape is to be used, the operator merely presses levers which move the fingers back to the parallel or unmolded position. Then, when brought forward again, they will form the matrix around the new piece.

The addition of "power" actuation to the basic principle of the contour-grip fixture makes it possible to use the device in automatic as well as manual operations. All models—manual, pneumatic, hydraulic, and solenoid valve, are built in four standard sizes, with maximum jaw openings ranging from 1 9/16 to 6 1/8 inches. In addition, specially engineered models for machine tools or holding fixtures can be built for specific needs.

Circle Item 571 on postcard, page 215

## Sixteen-Station Center-Column Machine for Processing Fuel-Pump Covers

A special sixteen-station center-column machine that performs milling, drilling, spot-facing, and tapping operations on six different cast-iron fuel-pump covers is announced by the Snyder Corporation, Detroit, Mich. This equipment is also designed to produce the same parts when they are made of aluminum. The production rate is eighty-one cast-iron parts per hour at 100 per cent efficiency.

The number of holes and the positions of the holes are different in each part. To handle the different parts with minimum change-over time, a method of utilizing multiple-spindle drill heads was devised that provides spindles for drilling all of the holes in the six different covers. Thus, to change the setup for the production of another part merely requires insertion or removal of tools from certain spindles. Speed and feed change-gears or V-belt pulleys in the Snyder standard milling, drilling, and tapping units accommodate the change from cast-iron to aluminum parts.

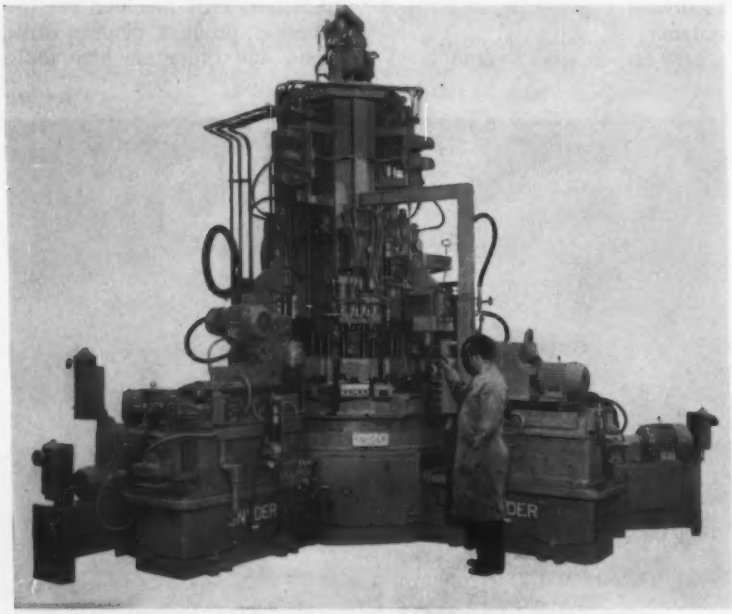
Both sides of the fuel-pump covers are milled and drilled. This is accomplished by utilizing eight two-position fixtures that are indexed through sixteen machining stations. In one position in each fixture the part is clamped with the top side up. The bottom side is up in the other clamped fixture position. At the loading station the operator removes a finished part from the second fixture position, moves a partially finished part from one fixture position to the other, and loads a rough part in the first position. A two-jaw chuck with V-type serrated jaws clamps the rough part in the first position. A pair of bayonet type toe clamps holds the part down on a milled face in the second fixture position.

A way type hydraulic slide unit with a two-spindle milling head is mounted on a wing base of the machine to perform the milling operations at Station 3. Three other hydraulic way type slide units, mounted on the center column, support 11-, 12-, and 13-spindle drill heads and bushing plates for performing the drilling, reaming, chamfering, and spot-facing operations at Stations 5 through 11.

Two single-spindle drilling units mounted on the center column drill small holes at Stations 8 and 10. A way type hydraulic slide unit with a two-spindle head and bushing plate is mounted on a wing base at Station 13. A similar unit with a four-spindle combination vertical and horizontal tapping head performs tapping operations at Station 15.

This special sixteen-station equipment is constructed of standard Snyder units. It has a 56-inch diameter cast-iron index-table mounted on cartridge type roller bearings. The index-table is driven by a fluid-motor and bull-gear arrangement to the hydraulic shot-bolt index positions. The base is of welded-steel construction and supports the cast-iron center column. A manually operated central lubrication system serves all sliding and rotating surfaces in the machine.

Circle Item 572 on postcard, page 215



Snyder special machine that mills, drills, reams, chamfers, spot-faces, and taps six different parts made of either cast iron or aluminum




Machine for checking bevel-gear blanks built by Gleason Works

## Gleason Bevel-Gear Blank Checking Machine

The development of a new method for checking bevel-gear blanks has been announced by the Gleason Works, Rochester, N. Y. The method involves the use of a new system of inspection tolerances. Besides eliminating an important source of errors in earlier systems, the tolerance system makes it possible to employ the versatile Gleason No. 15 bevel-gear blank checker equipped with a universal fixture.

The inspection system eliminates the crown (or outside diameter) as a reference surface, since this surface cannot be located accurately once a radius is turned on the crown. It deals only with the face angle and back-cone angle, and yields results entirely consistent with good running qualities, and with design tolerances. It is not necessary to change existing design drawings, or existing systems of design tolerances.

The machine uses simple dials and wheels to replace earlier hand operations. The gear blank is mounted on an arbor on the work-spindle table. The table has a horizontal adjustment and double dial for making the outside-diameter setting. The measuring head has a vertical adjustment with a double dial for making the crown-to-back dimension setting.

An adjustable slide carries an indicator and can be set to the face angle or back angle. With the vertical adjustment, horizontal adjustment, and face angle all properly set, the indicator reads zero as it trams the face cone of a perfect blank. Noting the manner in which the indicator varies from zero with an imperfect blank, the operator can easily identify the error as one of face angle, back angle, outside diameter, or crown-to-back dimension.

In tramming the face angle, for example, a variation in the reading indicates a face-angle error, while a constant reading—different from zero—indicates a crown-to-back error. The simple system of tolerances enables an untrained operator to determine whether a blank is acceptable or needs reworking. The checker will handle blanks ranging from 2 to 15 inches in diameter. It requires a floor space 22 by 32 11/16 inches.

Circle Item 573 on postcard, page 215

## DeVlieg "Spiramatic Jigmils" Equipped with "Diatrol" Dimensioning System

The DeVlieg Machine Co., Royal Oak, Mich., has announced a direct dial dimensioning system for its "Spiramatic Jigmils." This system, known as "Diatrol," provides a simplified and accurate means of pre-setting dimensions for automatic point-to-point positioning. By eliminating the use of measuring rods, Diatrol control allows direct dialing of positive or negative dimensions from any arbitrarily selected datum plane within the range of the system.

It is claimed that measuring accuracies which are well within the tolerance range of the Jigmil can be obtained repeatedly. This makes the system well adapted for jigless boring of custom or small-lot jobs.

Diatrol was developed by DeVlieg exclusively for its Jigmils. The system utilizes compact plug-in units containing the latest type transistorized electronic circuitry designed for dependability and easy replacement. The measuring portion of the system is capable of being calibrated to the ultimate in accuracy, and the measuring, positioning, and control elements are completely protected.

Circle Item 574 on postcard, page 215



Spiramatic Jigmil equipped with "Diatrol" dimensioning system

## Barnes High-Production Honing Machine

A completely new honing machine designed to hone bores ranging from 1/2 inch to 6 inches in diameter is being introduced by Barnes Drill Co., Rockford, Ill. Outstanding features of this Model 244 machine are its compact design and the simplicity of its controls. The BarnesdriL Plugmatic bore-to-bore sizing unit on this machine consistently maintains bore-to-bore dimensions within limits of 0.0002 inch.

An electric hone-expansion unit gives infinite hone feed adjustment without the tubes and rectifiers required in electronic controls. Rapid expansion, rapid collapse, and automatic compensation for stone wear are electrically controlled. When the limitation of stone wear is reached, lights on the control panel warn the operator, and interlocking controls prevent starting a new honing cycle until new stones have been inserted. Honing tool adjustment is remotely controlled.

The machine is available with one or two spindles in a choice of three different stroke lengths. Stroke length is controlled by a dial mounted on the rear of the control-panel arm, and the four-speed transmission is controlled by a knob on the right side of the spindle head. The accurate reversal stroke permits short stroking at any point in the bore, and the machine is suited particularly for honing ported bores. Air counterbalance insures smooth reversal of the stroke. When the machine is shut off, both the air counterbalance and the hydraulic system lock the head in place.

All electric controls are built into the two side panels in the machine itself. Since no auxiliary panels are used, external conduit is kept to a minimum. Setup controls are protected by lock and key.

A 30-gallon coolant reservoir is an integral part of the machine base. A 5-hp motor provides power for the spindle drive through a V-belt, and hydraulic reciprocation is powered by a 3-hp motor.

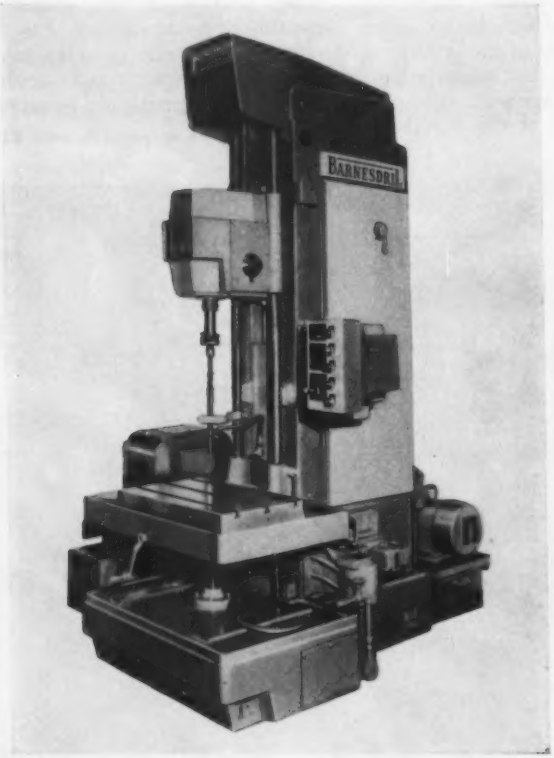
Circle Item 575 on postcard, page 215

## Projection Welder

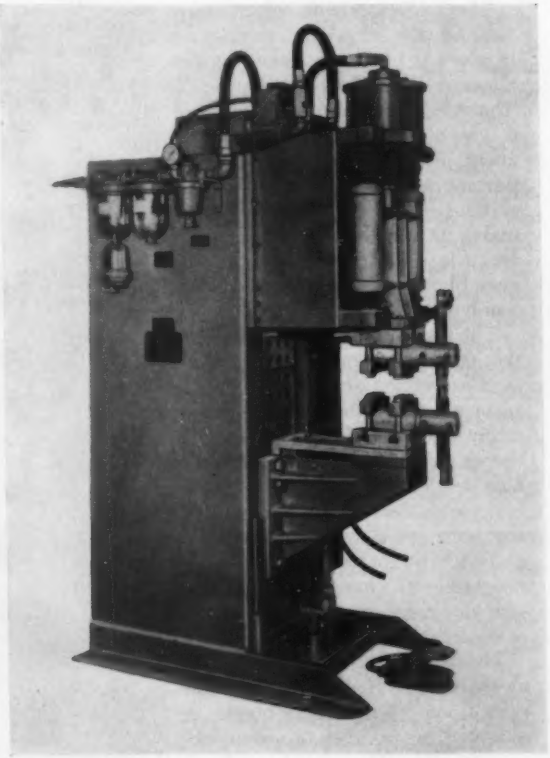
A single-phase projection welder said to produce welds that meet the most severe requirements has been developed by the Universal Electroweld Division, Electric Arc, Inc., Newark, N. J. This welder has a special "Heat-Vector" device for the automatic control of the up and down slope of the welding current, and is designed to provide the exact heat cycle needed to produce the strongest welds.

Nonbinding ram performance and instant follow-up in controlling weld properties are among other advantages claimed for this machine, which is equipped with light-metal rams and Electroweld's new lineal ball-bearing sleeve. Need for replacing or regrinding the ram has been completely eliminated, as the design makes it possible to provide a new wearing surface whenever needed by a slight turn of the shaft in the ball-bearing sleeve housing. Controls may be readily added as wanted for fully automatic operation.

Circle Item 576 on postcard, page 215




Compact high-production honing machine introduced by the Barnes Drill Co.



Projection welder developed by the Universal Electroweld Division, Electric Arc, Inc.



Vertical table-top broaching machine

## Pioneer Broaching Machine

A low-cost model has been added to the series of vertical table-top broaching machines made by the Pioneer Broach Co., Los Angeles, Calif. The machine—Model VM215-3—has multiple features designed to make it a valuable machine tool addition to the custom tool and die shop, as well as the high-production plant. Numerous surface-broaching and internal-broaching applications are within the scope of this machine. In the internal broaching of keyways and square, oblong, hexagonal, irregular, splined or round holes, the vertical pull-down action of this machine is said to contribute to the inherent accuracy of the broaching tool. Surface broaching is easily handled by the use of combination work-holding broach guide fixtures.

The VM215-3 is a fully hydraulic machine with a 15-inch cutting stroke, a 15-fpm (foot per minute) cutting speed, and 38-fpm return speed. Normal power is conservatively rated at 2 tons. The work-table measures 16 by 16 inches. Being clear of obstructions, it will accommodate all sizes of work-pieces.

Operation is extremely simple and the tool can be set up quickly. High-production broaching, with dimensional tolerances as close as 0.0005 inch, can be handled by unskilled operators. The machine is supplied with 2-hp hydraulic motor, coolant motor, and all switches. It requires a floor space 42 by 53 inches. Controls for fully variable cutting speed and a 3-hp motor are available.

Circle Item 577 on postcard, page 215

## Lamb Machine Designed to Grind Oil-Grooves in Transmission Gears

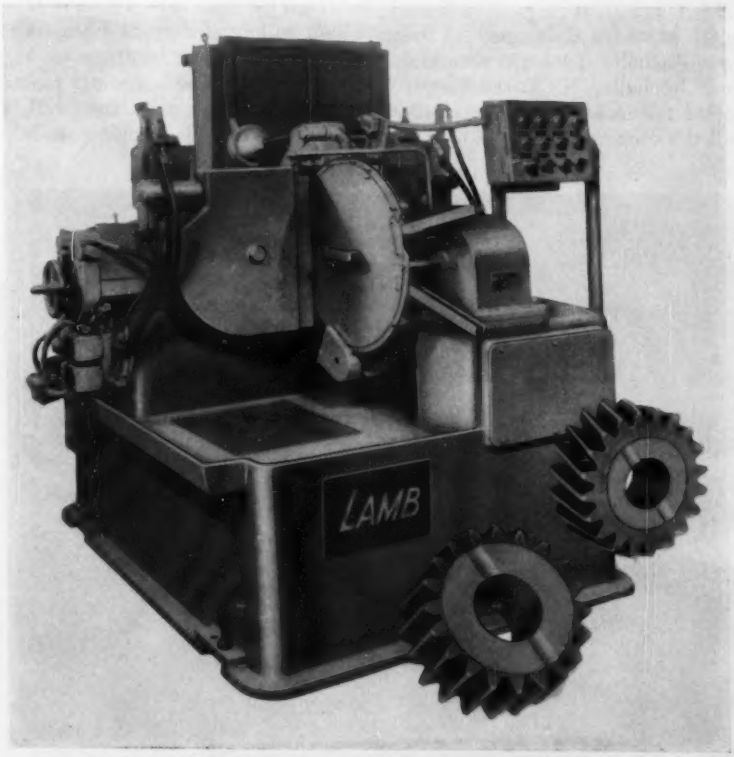
A machine designed and built to grind oil-grooves in both of the thrust faces of hardened transmission gears was recently announced by the F. Jos. Lamb Co., Detroit, Mich. This unit has a production rate of 800 to 1350 parts per hour, depending on the gear size. It operates continuously and is completely automatic, including wheel dressing and compensation for wheel wear.

The parts are chute-fed to a rotating, spur type feed-wheel that is chain driven. The chain rides on the periphery of the feed-wheel and acts as a clamp, holding the parts in the spur pockets as they are passed between the opposed grinding wheels. After grinding, the parts drop out of the spur pockets into a discharge chute.

Only the feed-wheel need be changed to accommodate a different gear size. Micro adjustments of the grinding-wheel slides can be set for new part-width and groove-depth dimensions. Wheel dressers can be adjusted to any desired radius. The counter for wheel-dressing frequency is also adjustable. Grinding wheels are 16 inches in diameter and 1/4 inch wide.

The wheel feed slides are powered hydraulically by a 5-gallon hydraulic power package. All hydraulic and electric components conform to JIC standards. The machine has a coolant tank located within its base. Single-wheel models for one-side gear-groove grinding are also available.

Circle Item 578 on postcard, page 215




Machine equipped to grind oil-grooves in transmission gears, brought out by F. Jos. Lamb Co.

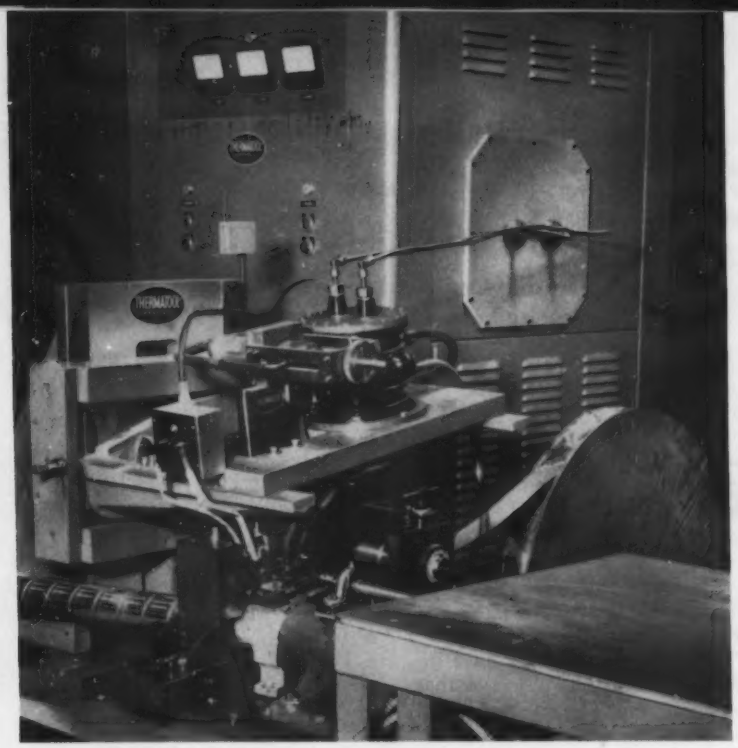


Fig. 1. Thermatool setup consists of generator, transformers, rolling mill, and welding station. Coil strip can be seen on the right entering the mill

## Spiral Tube Mill and Welder

A "Thermatool" electronic mill which converts flat coil strip to welded spiral tubing of infinite length has been developed by the New Rochelle Tool Corporation, New Rochelle, N. Y. Diameters from 1 1/2 inches to 10 feet, with wall thicknesses from 0.004 to 3/8 inch, can presently be produced. Being compact, the equipment can be toted by truck and set up right where end product is to be used.

Basic equipment consists of a motor-driven mechanism that draws the strip into the mill, moves it through forming rolls that effect the spiral shape and the desired diameter, and delivers the formed open seam to the welding head. The coil strip, several thousand feet long, is on a spindle at the end of the mill, and enters at a pre-set angle to produce the required number of spirals per foot. (The greater the number of spiral welds per running foot, the greater the stiffness of the tube.)

As the strip is spiraled, it makes an elongated vee, and the weld occurs at the root of the vee. Two sliding contacts, one on either side of the open seam, introduce current into the metal. The current reverses at a very high rate—450,000 cycles per second—compared to line frequencies of 60 cycles. This current does not follow the direct low-resistance path between the contacts, but the long, low-inductance path. Each side of the vee is a return conductor for the other, since the current tends to flow on the two facing surfaces of the material. These are the surfaces being welded.

The two contacts ride about 1 or 2 inches from the root of the vee. Characteristics of the high-frequency current cause it to hug the opposite edges of the metal. This skin effect produces localized high-intensity heating so that the edges at the root of the vee reach welding temperature. Pressure applied at the root produces a forged weld—lap, mashed lap, or butted edge, as desired. It has been determined that the mashed weld is the most effective.

The equipment can weld ferrous and non-ferrous metal, including aluminum and copper with 100 per cent conductivity, and some of the rarer metals, such as zirconium. Due to the stiffness that the spiral weld gives to the tubing, the wall thickness can be substantially reduced and large savings effected. Such an economy could be very evident in the production of large tubing used in barrels and other cylinders of that type.

Circle Item 579 on postcard, page 215

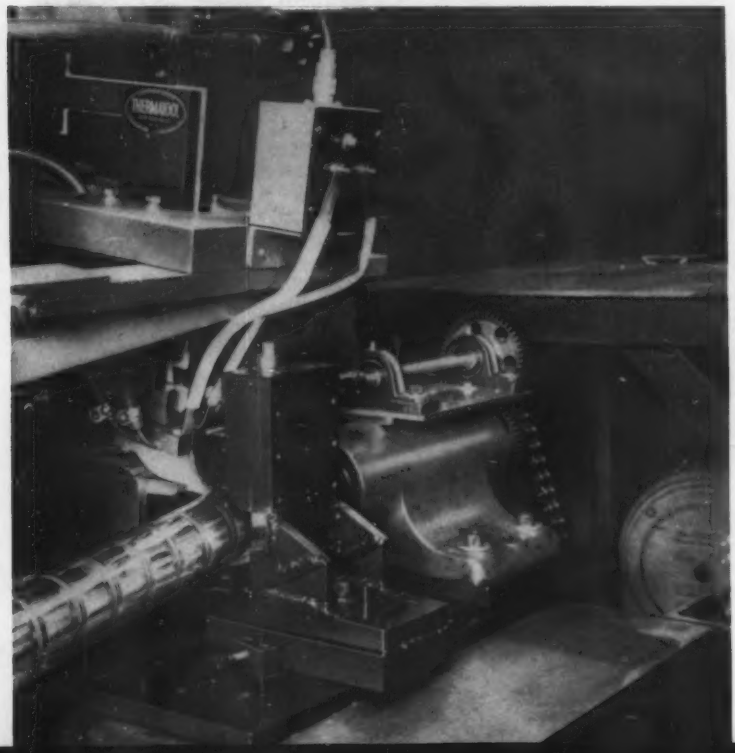
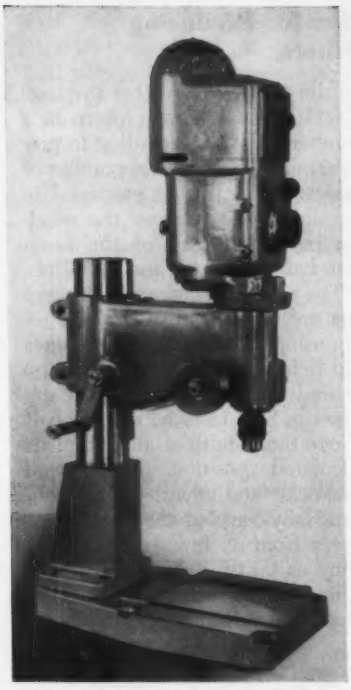


Fig. 2. On the left, completed tubing leaves the welding station. Leads from the output transformer in center connect sliding contacts that ride on each side of the open seam to be welded



Swedish-built drill press introduced by Homestrand, Inc.

### Arboga Drill Press

The Arboga factory in Sweden has brought out a drill press, designated the EV-10, which is being introduced in this country by Homestrand, Inc., Larchmont, N. Y. This machine has a drilling capacity in steel of 3/8 inch, an infinitely variable speed range from 1200 to 7200 rpm, a swing of 18 inches, and a quill travel of 3 inches. The maximum distance from spindle to table is 12 inches and the table size, 10 by 17 inches.

**Circle Item 580 on postcard, page 215**

### 150-Ton Electric Hydraulic Press

A motorized hydraulic press, designed to handle heavy-duty jobs requiring pressures up to 150 tons, has been introduced by the ACCO Equipment Division, American Chain & Cable Co., Inc., York, Pa. This machine has been developed for use in maintenance shops, rolling mills, railroad repair depots, factories, and machine shops. It is available in two models for different operating characteristics. The Model MPH-150-E22 is equipped with a 2-hp motor and has a ram speed at no load of 4.2 inches per minute and 2 inches per minute at full load. The Model MPH-150-E55 is equipped with a 5-hp motor and has a ram speed at no load of 11 inches per minute and 7.5 inches at full load.

Other operating characteristics identical for both units are: ram travel, 8 inches; screw travel, 8 inches; table travel, 24 inches; horizontal head travel, 19 3/8 inches; maximum ram to table distance, 29 1/2 inches; height, 91 1/4 inches; width between uprights, 48 inches; and width between table channels, 12 1/4 inches. Each machine requires a floor space 45 by 73 inches.

**Circle Item 581 on postcard, page 215**

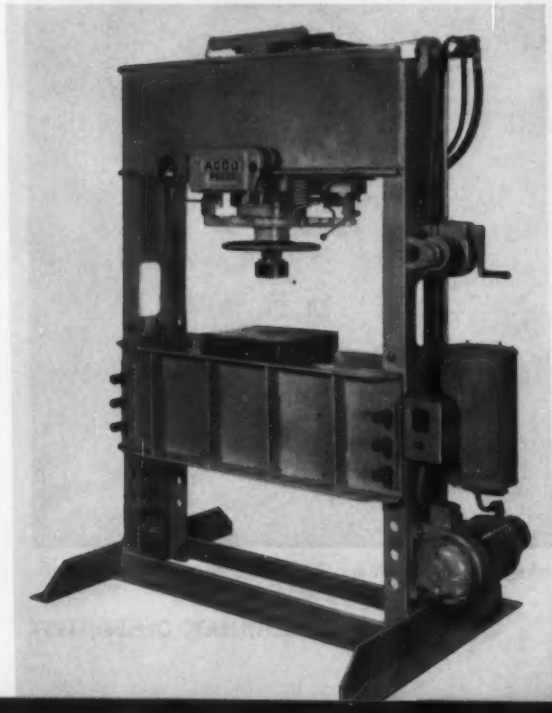
### Motorized Hydraulic Bar and Angle Shear

A motorized hydraulic bar and angle shear with a shearing capacity up to 4- by 4- by 3/8-inch angle iron is being manufactured by the Shearease Co., Inc., Torrance, Calif. This shear will also handle 3 1/2-inch wide flat stock and up to 1-inch diameter and 1-inch square bar stock. The operating speed is twenty strokes per minute. Direct drive to the vane type pump is by a 3-hp electric motor. Maximum capacity is 50 tons.

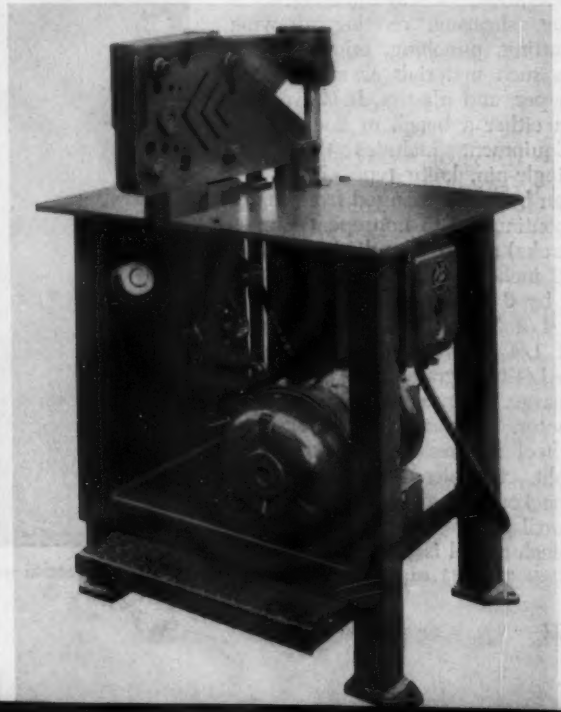
An exclusive, patented progressive shearing action facilitates quiet shearing of any bars within the shear's capacity. The table is 20 by 30 inches.

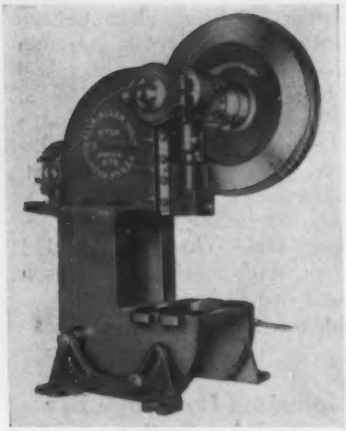
**Circle Item 582 on postcard, page 215**

Electric hydraulic press announced by American Chain & Cable Co., Inc.



Shearease motorized hydraulic bar and angle shear of 50 tons capacity.





Allen 8-ton power punch press

## Bench- or Floor-Model Power Punch Press

The Alva Allen Industries, Clinton, Mo., has announced a Model BT-8, 8-ton power punch press designed to meet the need for a machine with a capacity range between its 5- and 12-ton models. This new press has a shut-height die space of 7 inches (distance from ram to bed, standard stroke down, adjustment up), and a 5-inch throat (distance from center of ram to back of die space). However, it is available with a die space of 8 1/2 inches shut-height and 10-inch throat which will permit handling of larger parts.

This machine can be easily set up for any standard punch-press operation, such as blanking, forming, shearing, riveting, drawing, cutting, punching, crimping, etc., in such materials as metal, fiber, paper, and plastics. It is available in either a bench or floor model. Equipment includes the Allen single-pin, knife type clutch that can be easily changed from repeat (continuous) to nonrepeat (single-stroke) action. The die-bed is 7 by 12 inches with a bed opening of 4 by 6 inches. Standard stroke is 1 1/2 inches with special strokes of 1/4 inch to 3 inches available in 1/4-inch graduations at an extra charge. The press requires a 1/2-hp motor. The heavy, 115-pound flywheel assures ample power. A split, two-piece ram and ram knockout are available at an additional charge. The weight of the bench model is 430 pounds.

Circle Item 583 on postcard, page 215

## Sheffield Winding Machine for Producing Fine-Mesh Filters

Special equipment recently built by the Sheffield Corporation, Dayton, Ohio, includes a winding machine for the Bendix Aviation Corporation. This fully automatic machine has been developed for use in the production of porous-metal filters. It is designed to wind a continuous strand of fine flat wire on a ceramic-coated mandrel to produce Bendix "Poroloy" porous metal filters with precisely defined pore paths.

The Poroloy filters serve to remove submicronic particles from fluids such as those used in hydraulic servo valves, missile, and aircraft controls. In addition to the higher productivity of this new machine, its greater accuracy in winding the wire, as compared with that of previously used equipment, results in the production of more efficient filters capable of removing particle sizes down to 1/2 micron (approximately 0.000039 inch).

The winding operation is a little like reeling in a fish with the ceramic-coated mandrel representing the spool and the oscillating shuttle the level wind except for this important difference: the shuttle sweeps the rotating mandrel from one end to the other, reversing itself on the return so that the wire is laid in a crisscross pattern in a number of layers according to predetermined spacing and number of passes. Cotton string was used in the illustration to show the winding pattern instead of the finer-than-hair wire used for the filters.

The machine staggers each wind to a pre-set pattern so that the relationship of each wire to the ones laid before and after results in the desired pore size and path. Each wire can be laid to within one-half of one thousandth of an inch of its calculated position. Filter wall thickness and density are controlled by varying the number of layers from as few as four to as many as thirty. Before the wire is wound on the mandrel, it goes between two carbide rolls that flatten it to a thickness approximately 50 per cent of its diameter. The width of the flattened wire is held to size within plus or minus 0.0001 inch and is gaged during setup with a Sheffield Accutron electronic dimensional comparator.

The winding machine illustrated, designed and built by Sheffield, will wind ribbons of stainless steel, copper, nickel, and other materials ranging from 0.0007 inch thick by 0.002 inch wide to 0.003




Special winding machine built by Sheffield Corporation

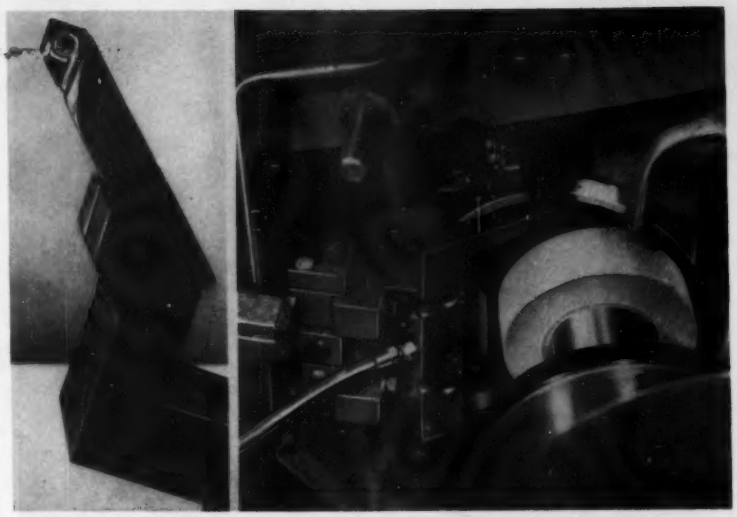
inch thick by 0.012 inch wide. Winding speed ranges up to 1000 feet per minute. Mandrels with diameters ranging from 1 to 12 inches and lengths up to 28 inches can be accommodated.

After winding, the wire mesh is sintered in a controlled atmosphere furnace to bond the crossing wires at each point of contact. Following this, the seamless porous tube is removed from the mandrel for further processing as Poroloy cylindrical or flat stock. The porous metal can be formed, welded, and silver-soldered.

**Circle Item 584 on postcard, page 215**

## Gage Head for Controlling Inside Diameter Grinders

An "air-fork" gage head designated Model 133 M-195 has been announced by the Federal Products Corporation, Providence, R. I. This gage is designed to provide effective size-control gaging on internal grinders which handle work down to 1 1/4 inches in diameter. The fork shape of the gage head permits it to remain in straight or tapered work continuously without interfering with the reciprocating action of the wheel. In taper grinding, use of the air fork (shown in side view at left) eliminates the need for a mechanical contact caliper which would tend to burnish the work. Since the air fork can remain in the piece, its measuring cycle is not limited to a series of brief intervals, as in the case of the conventional plug. This simplifies the air system required and reduces its cost.

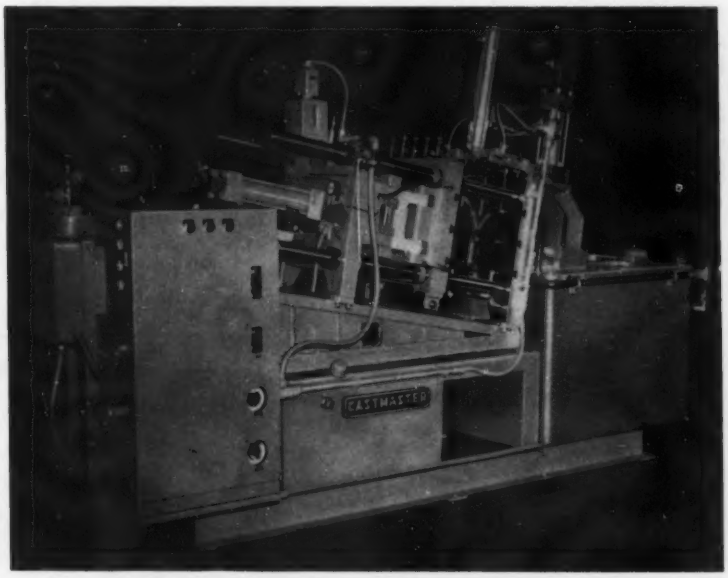


"Air-fork" gage head for controlling internal grinding operations

Design of the air fork as well as the Federal air-electric gaging system with which it is used permits it to be made 0.017 inch smaller than the finish size. Each air fork is equipped with tungsten-carbide guard buttons which prevent it from being damaged in case a badly undersized piece is fed to the machine.

In a typical installation, the wheel grinds at a fast rate until the piece is within about 0.0005 inch of the finish size, at which point the gage causes the machine to retract and dress the wheel. Grinding is then resumed, but at a finish rate. The gage then retracts the wheel automatically as soon as the finish size is reached. With this control five machines, or more, can be attended by one man.

**Circle Item 585 on postcard, page 215**




"Cast-Master" automatic, hot-chamber die-casting machine

## High-Speed Die-Casting Machine

A completely automatic, 100-ton, hot-chamber die-casting machine has been announced by "Cast-Master," a subsidiary of H-P-M, which, in turn, is a division of the Koehring Co., Milwaukee, Wis. This unit, called the Model 7Z, is designed for extremely fast production—up to 1000 shots per hour—of small zinc castings.

The machine features inclined platens and an injection cylinder designed to keep nozzle drippings to a minimum and to permit castings to fall freely. The die-mounting plates are 21 1/2 by 21 1/2 inches and the space between the tie-bars, 13 1/2 by 13 1/2 inches. Maximum die stroke is 8 inches and the injector cylinder stroke, 6 1/2 inches.

**Circle Item 586 on postcard, page 215**



Fig. 1. Supfina microstoning attachment introduced by Taft-Peirce

## Taft-Peirce "Microstoning" Attachments

The Taft-Peirce Mfg. Co., Woonsocket, R. I., is bringing out two "microstoning" attachments for use on lathes and other standard machine tools. "Microstoning," created by the West German machine tool firm of Supfina-Wieck & Hentzen, is an abrasive final-finishing process that generates a controlled micro-inch finish on practically any material. It also corrects geometrical errors caused during previous machining operations. The process is equally well adapted to single-piece finishing or repetitive production work, using the No. 9681 Supfina attachment seen in Fig. 1, or the No. 9680 attachment, which is designed for mounting on the toolpost of a small engine lathe. These attachments, licensed to Taft-Peirce for manufacture and sale in this country, are most frequently used on lathes, although they can be adapted quite easily to vertical turret lathes, boring mills, and even planers.

For horizontal lathe work, the attachment is mounted on the toolpost, and an abrasive stone of uniform grit size and dispersion is held under constant pressure against cylindrical work mounted between the centers. The operating principle is illustrated by the diagrams in Fig. 2. The stone oscillates at a pre-selected amplitude against the rotating work-piece while the lathe saddle is power-fed along the work axis. The stone removes the amorphous skin and other imperfections left by previous machining and imparts a fine finish to the base metal, which is said to result in a sounder metallurgical structure.

In addition to generating a uniform and controllable micro-inch finish, microstoning is said to expose and correct geometric errors such as lobed out-of-roundness and grinding-feed or chatter marks. By choosing stones of corresponding hardness it is possible to finish soft metals just as easily as hard ones with no danger of loading the surface with abrasive particles.

Fig. 1 shows a No. 9081 Supfina attachment being used to microstone a steel guide shaft 20 inches in length by 1 1/4 inches in diameter. Before microstoning, the surface finish was 12 to 15 micro-inches. After microstoning, the finish averaged 1 micro-inch. Other typical applications include the finishing of machine tool spindles, camshaft bearings, and guide pins.

In operation the attachments are oscillated back and forth at their natural frequency by means of a unique pneumatic system that uses a minimum volume of compressed air. A free-floating piston inside the head moves in opposition to the body, which accounts for a remarkable freedom from externally transmitted vibrations. This patented self-balancing principle allows the attachment to oscillate at high frequencies said to be unsafe or impossible to obtain with mechanically driven units.

The maintenance of controlled finish requires a continuous flow of clean coolant (mineral seal oil and 10 per cent machine oil). A specially designed lubricant pumping unit and tank, equipped with a magnetic baffle separator and fine filter, will be provided for both Supfina attachments. The No. 9680 Supfina attachment is a small unit weighing 25 pounds. The No. 9681 attachment, weighing 64 pounds, is larger and more heav-

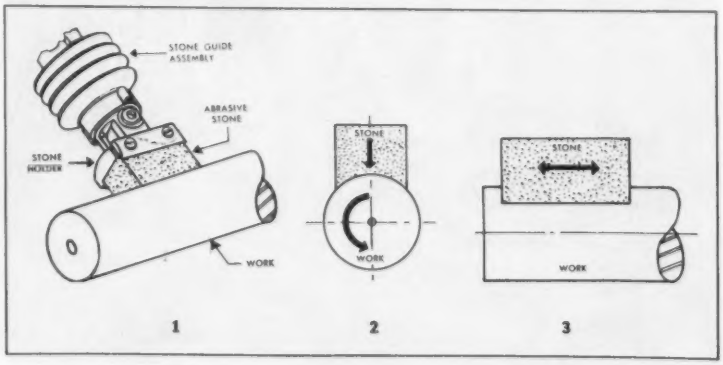



Fig. 2. Diagrams illustrating microstoning process

# This is all the room you need to weld with LINDE's "MIGHTY MIDGET"



SHOWN ACTUAL SIZE IN 3-IN. OPENING

## ... New Heliarc HW-20 Torch

### HIGH CURRENT CAPACITY

Operates at 200 amperes *continuous* duty, AC or DC. Molded, totally closed water-cooling system eliminates any chance of leaks at torch head.

### MINIATURE SIZE

9/16- by 2-5/16-in. torch head permits welding in hard-to-reach areas as small as 3 in. in diameter. Total torch length is under 7 inches.

### 3.3-OZ. FEATHERWEIGHT

Selected materials, such as glass fiber reinforced phenolic plastic, save weight without sacrificing strength. Torch (with short cap) weighs only 3.3 ounces.

### HANDLES LIKE A PENCIL

Exceptional balance, light weight, small size, and super-flexible service lines make the HW-20 torch as easy to handle as a pencil.

For further information, call your local LINDE Office or LINDE Distributor . . . or write: Dept. MY-10, LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, New York.

The terms "Heliarc," "Linde," and "Union Carbide" are registered trade marks of Union Carbide Corporation.

### SPECIFICATIONS

**Capacity—**
200 amp. AC or DC, continuous duty cycle;
225 amp. AC or DC, reduced duty cycle

**Weight—**
with short cap: 3.3 oz.*
with medium cap: 3.5 oz.
with long cap: 3.6 oz.

**Length overall—6⅞ in.**

**Length of Torch Head—**
with short cap: 2-19/64 in.*
with medium cap: 3-9/32 in.
with long cap: 7-5/16 in.

**Maximum Handle Diameter—¾ in.**

**Maximum Head Diameter—9/16 in.**

**Service Lines—12½ or 25 ft.**

*Torch is supplied with medium cap for 3-in. electrodes. Short cap for 2-in. electrodes and long cap for 7-in. electrodes are available as accessories.

Linde UNION CARBIDE

ily proportioned. Both units are supplied with a standard mounting bar, a single stone guide assembly, and one stone holder. The minimum diametral capacity of both attachments is 1/4 inch, which is governed by the minimum practicable stone thickness. The maximum diametral capacity is unlimited for either attachment, although the larger unit is recommended for achieving a better production rate in microstoning work over 1 inch in diameter. Air consumption for the smaller attachment is from 50 to 100 cubic feet per hour and for the larger one, 100 to 200 cubic feet per hour. Oscillating frequency ranges from 2000 to 2500 strokes per minute. Stroke is from 0.078 to 0.234 inch.

**Circle Item 587 on postcard, page 215**

## "Aircomite" Welding and Cutting Outfit

A moderately priced gas welding and cutting outfit, called the "Aircomite," has been announced by Air Reduction Sales Co., a division of Air Reduction Co., Inc., New York City. With this outfit, operators can weld steel up to 3/8 inch thick and cut up to 1-inch-thick steel plate, as well as perform brazing and hard-facing operations. Built for light- and medium-duty industrial service, it can be used by air-conditioning and refrigeration manufacturers, in auto-body repair and sheet-metal shops, and for maintenance purposes in a wide variety of industries.

The outfit includes one oxygen and one acetylene regulator, one welding torch with three tips, one cutting attachment and tip, one pressure mixer with gas sealing rings, a pair of welding goggles, 12 1/2 feet of 3/16-inch neoprene-lined twin hose with connections, one spark-lighter, and one all-purpose wrench. It is packaged in a mechanic's metal carrying case.

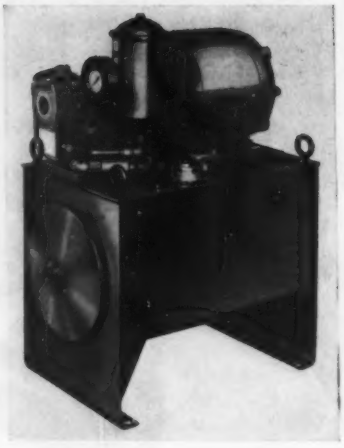
The Airco oxygen and acetylene regulators provided with the outfit have forged-brass bodies and spring cases, with a polished and lacquered finish. Gages are the screw bezel type with clear plastic crystals and bold markings. The oxygen regulator is equipped with a 60-psi working-pressure gage and a 4000-psi high-pressure gage with silver-soldered bourdon tube connections. On the acetylene regulator, a 30-psi and a 400-psi gage of the same quality are used.

Additional cutting tips for thicker steel, as well as auxiliary equipment for special jobs in welding, brazing, and cutting, are available for use with this equipment.

**Circle Item 588 on postcard, page 215**



Airco welding and cutting ouifit



Hydraulic power package unit

## Vickers Hydraulic Power Package

To meet the demand for a compact, versatile, and economical hydraulic power unit, Vickers Incorporated, Detroit, Mich., division of Sperry Rand Corporation, has announced its T10 10-gallon power package. This unit will provide hydraulic power and control for a wide variety of industrial machinery applications in the low-power range. These include the operation of gaging, transferring, roll-over, elevating, indexing, chuck, and clutch equipment.

The basic 10-gallon reservoir covers a floor area of only 25 by 14 inches. It is regularly equipped with cleanout covers, fluid-level indicators, combination breather and filler, removable baffle, and bottom drain plug. Optional features include such items as a return line filter with bypass check valve, a pressure line bypass filter, extra breather, and extra oil-level indicators.

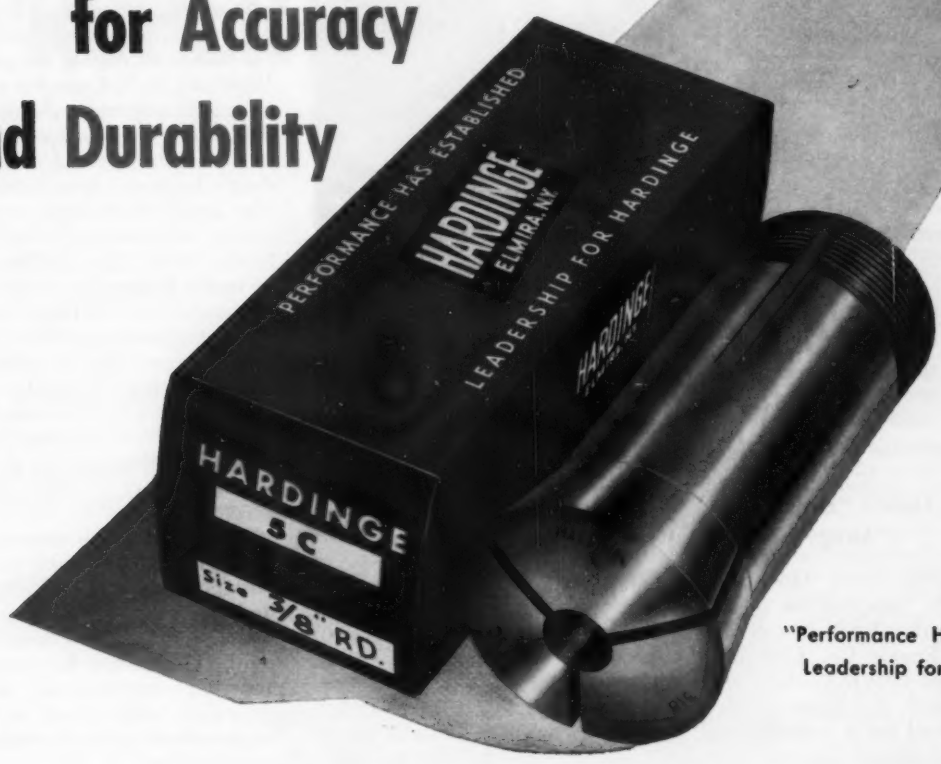
The power package is available in a variety of combinations of standard components assembled to suit individual requirements. Recommended maximum electric-motor size is 3 horsepower. The power package will accommodate the V-104 and V-114 balanced vane pumps and the VVI 5-gallon-per-minute variable-volume vane pump. The power package using either of the first two pumps includes a suitable relief valve.

**Circle Item 589 on postcard, page 215**

*(This section continued on page 208)*

# Specify HARDINGE Collets for Accuracy and Durability

HARDINGE
ELMIRA, N.Y.




"Performance Has Established Leadership for HARDINGE"

## For Your LATHES and MILLING MACHINES

**HARDINGE** Draw-in Collets symbolize accuracy, long life, and low cost because they are hardened and ground both internally and externally, have heat treated threads, — and cost no more than ordinary collets.

HARDINGE Collets assure you of all - essential accuracy plus durability and economy.




Write for Bulletin 56 — Complete collet ordering information for all Lathes and Millers.

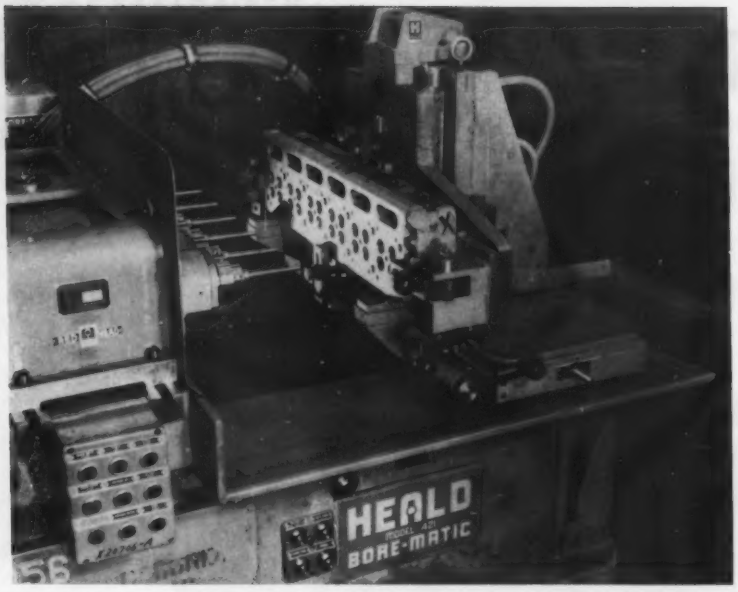
**HARDINGE BROTHERS, INC., ELMIRA, N. Y.**

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

Immediate stock delivery from Elmira, Boston, Atlanta, New York, Hartford, Philadelphia, Rochester, Dayton, Detroit, Minneapolis, Chicago, St. Louis, Oakland, Los Angeles, Toronto, Montreal.



For more data, circle this page number on inquiry card 207




Bore-Matic used to process cylinder heads in plant of Cummins Engine Co.

## Heald "Bore-Matic" Equipped to Process Large Cast-Iron Cylinder Heads

A standard Heald Model 421 "Bore-Matic" adapted for special-purpose work is being used by the Cummins Engine Co., Columbus, Ind., to finish-bore forty-eight holes in four passes on a large cast-iron cylinder head for a supercharged engine. The equally spaced holes are for valve seats, insert seats, and valve guide bushings. The standard Bore-Matic, built by the Heald Machine Co., Worcester, Mass., is equipped with a six-spindle cluster head and hydraulically operated vertical indexing fixture. All forty-eight holes in the cylinder head are finish-bored and faced in four operations at a single chucking on this machine. Stock removal is 0.015 inch in the bore and 0.025 inch in the seats. Production of 5.4 pieces per hour at 70 per cent efficiency is obtained.

The work is hand-clamped in the angle-plate fixture with the cross-slide in its forward position and the vertical slide in its lower position. The table moves left at rapid traverse and then slows down to bore, counterbore, and take a plunge facing cut. The table next moves out to rest and six holes in the upper bank are finished. The cross-slide is then indexed to the rear and the cycle is repeated to complete the twelve upper holes.

The vertical slide is then raised to the upper position, bringing the lower bank of holes in line with the boring heads, and the cycle is repeated—once with the cross-slide at rear and again with the cross-slide forward. The table is interlocked so that it will not feed "in" unless both slides are properly indexed, thus protecting machine.

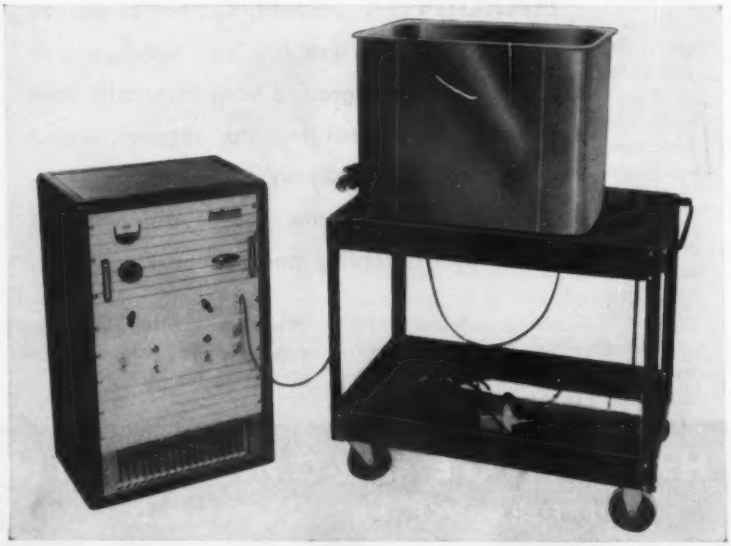
Circle Item 590 on postcard, page 215

## Ultrasonic Cleaners

A miniature bench-size vapor degreaser, a powerful 1-kilowatt, 35-gallon capacity ultrasonic cleaning system, and a dual-purpose laboratory-size cleaning and processing unit have been brought out by the Narda Ultrasonic Corporation, Westbury, N. Y. A number of other advanced ultrasonic cleaning machines especially adapted for use in the electronics and aviation industry have also been introduced. The small, single-stage vapor degreaser is known as the SonBlaster Model D-601. This 1-gallon capacity unit is believed to be the smallest machine of its kind. It is designed to insure that the ultrasonically cleaned part is absolutely free of any residual, contaminated solvent when it is removed from the bath. This is accomplished by suspending the part in the condensing vapors of pure distilled solvent.

The dual-purpose cleaning and processing unit known as the SonBlaster Series 400 consists of a Model G-401 ultrasonic generator and a Model NT-401 transducerized tank. Items can be cleaned or processed simultaneously in two Pyrex glass beakers, each with different solutions, or in the tank itself as a single unit.

In the 1-kilowatt range of king-size ultrasonic cleaners are the SonBlaster Model G-10001 ultra-

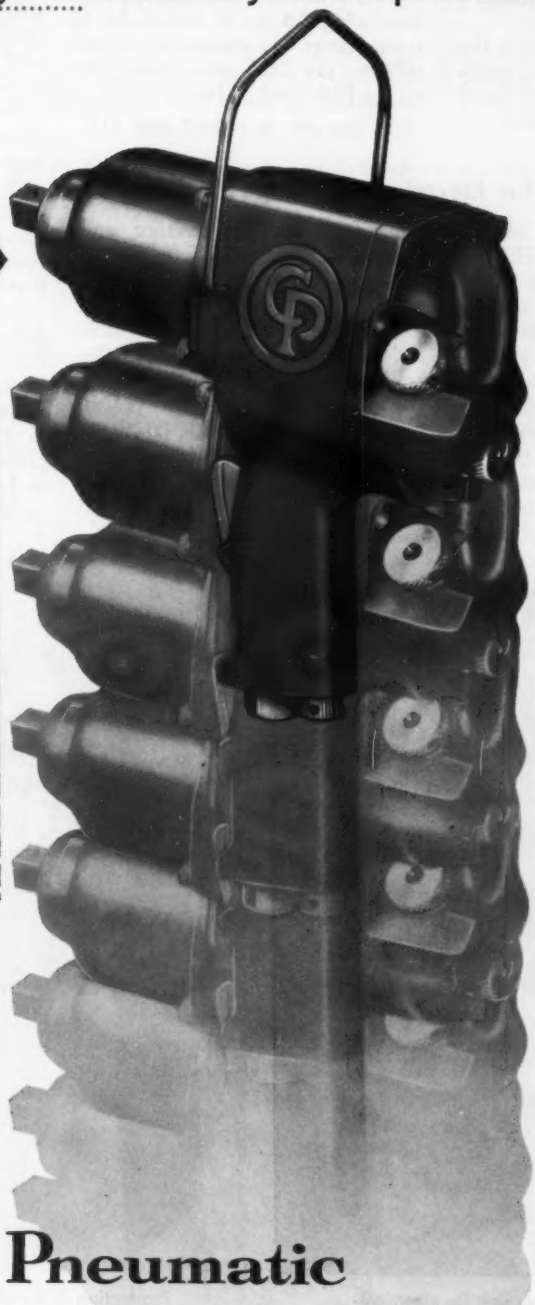


King-size ultrasonic cleaner introduced by Narda Ultrasonic Corporation

don't underestimate
the importance of

# PROPER BOLT TIGHTNESS

in your assembly line operations!



**CP-3440-TS** adjustable torque range 15 to 80 ft-lbs. ½" square drive.

**TORQUE CONTROL IMPACT WRENCHES**



**CP-3630-RTP** adjustable torque range 100 to 350 ft-lbs. ¾" or 1" square drive.



**CP-610-RTP** adjustable torque range 300 to 600 ft-lbs. 1" square drive.

* A complete line of Torque Control Screwdrivers and Nutrunners solve other threaded fastener torque problems. Available from No. 4 screw size to ⅜" bolt size.

More and more top-flight manufacturers are realizing that *proper bolt tightness* is a quality factor that gives them a sales edge over competitive products . . . their assembly line foremen know that the use of TORQUE CONTROL IMPACT WRENCHES in the driving of nuts and bolts to "correct torque" means:

- Less work spoilage
- No chance of sheared bolts or stripped threads
- Inexperienced operators learn nut running operations faster
- Less product failure

CP Torque Control Impact Wrenches give you the exact tightness you want in a fast, accurate, "one-shot" rundown that doesn't require a hand torquing follow-up to check work accuracy. Torque ranges from 15 to 600 foot pounds available.

Let a CP Fastener Specialist work with you on your problems. You'll be impressed by the easy handling qualities of these unusually compact tools. The torque control mechanism is totally enclosed and *all torque adjustments* are made quickly AND simply without special tools or fixtures. For further information, contact your nearest CP Office, or write: *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*

**Chicago Pneumatic**

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

sonic generator and Model NT-10001 35-gallon capacity tank shown in the accompanying illustration. Barium titanate transducer elements are integrally mounted on the underside of the tank in such a way as to make the tank bottom a diaphragm which generates uniform ultrasonic vibrations. These vibrations are transmitted throughout the entire contents of the tank, which measures 18 by 24 inches by 18 inches deep.

Another ultrasonic cleaner in the Narda line is an automatic, push-button-operated, two-stage ultrasonic vapor degreaser, called the "Jupiter" Model DVC-3000. This unit has a boiling sump, a 300-watt ultrasonic cleaning chamber, distillate reservoir, power-spray rinse, and filter recirculation system featuring all stainless-steel plumbing. Solenoid valves operated by push-buttons on control panel regulate all draining, filtering, and recirculating functions of this machine. It has a 6-gallon capacity, ultrasonic immersion sump measuring 16 by 8 inches by 8 inches deep. The dimensions of the cabinet are 56 inches long, 32 inches high, and 23 inches wide.

Circle Item 591 on postcard, page 215

## Power-Supply Units for Electrical-Discharge Machining

The Research Division of the Elox Corporation, Troy, Mich., has announced an entirely new series of power-supply units for electrical-discharge machining. The manufacturer states that more than a million dollars was expended in research work to make this the finest vacuum-tube power-supply equipment available. It is said to have 75 per cent fewer vacuum tubes than formerly required and that building block style "plug-in" units facilitate maintenance and service.

A unique feature of this equipment is that it can be sectionalized into split-output sections for multiple-electrode operation. A 100-ampere unit can be split into four 25-ampere sections. The power supplies come in 15-, 30-, 60-, 100-, 200-, 400-, and 1000-ampere sizes. Larger than 1000-ampere sizes can be supplied on special order.

Circle Item 592 on postcard, page 215

## Morse Drill-Point Grinder

A drill-point grinder for grinding conventional, formed, or split points on a high-precision, high-production basis has been introduced by the Morse Twist Drill & Machine Co., New Bedford, Mass. Time studies of a number of these machines now in use in the Morse production line show that the average operator can accurately grind over 450 No. 40 drills (0.098 inch) per hour. The rate is said to be correspondingly high for all other drill sizes.

One of the features of this machine, which makes possible its high-production rate, is a V-rest drill-holder. This device securely holds and positions each drill for grinding, eliminating the need for time-consuming loading or adjustment of bushings, jaws, or collets.

Other specially designed features incorporated in the Morse grinder are: a calibrated swivel fixture that grinds conventional points with included angle of 118 to 150 degrees, and provision for pointing all drill sizes from 1/16- to 1/2-inch diameter and up to 6 inches in length. Additional fix-

*(Continued on page 220)*



Elox vacuum-tube power unit for electrical-discharge machining



Production drill-point grinder introduced by Morse Twist Drill & Machine Co.

## TABLE FOR CONVERTING DECIMALS OF A DEGREE INTO MINUTES AND SECONDS—3

| Decimal of Degree | 0.000 | 0.001 | 0.002 | 0.003 | 0.004 | 0.005 | 0.006 | 0.007 | 0.008 | 0.009 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.710 | 42′36″ | 42′39.6″ | 42′43.2″ | 42′46.8″ | 42′50.4″ | 42′54″ | 42′57.6″ | 43′ 1.2″ | 43′ 4.8″ | 43′ 8.4″ |
| 0.720 | 43′12″ | 43′15.6″ | 43′19.2″ | 43′22.8″ | 43′26.4″ | 43′30″ | 43′33.6″ | 43′37.2″ | 43′40.8″ | 43′44.4″ |
| 0.730 | 43′48″ | 43′51.6″ | 43′55.2″ | 43′58.8″ | 44′ 2.4″ | 44′ 6″ | 44′9.6″ | 44′13.2″ | 44′16.8″ | 44′20.4″ |
| 0.740 | 44′24″ | 44′27.6″ | 44′31.2″ | 44′34.8″ | 44′38.4″ | 44′42″ | 44′45.6″ | 44′49.2″ | 44′52.8″ | 44′56.4″ |
| 0.750 | 45′00″ | 45′ 3.6″ | 45′ 7.2″ | 45′10.8″ | 45′14.4″ | 45′18″ | 45′21.6″ | 45′25.2″ | 45′28.8″ | 45′32.4″ |
| 0.760 | 45′36″ | 45′39.6″ | 45′43.2″ | 45′46.8″ | 45′50.4″ | 45′54″ | 45′57.6″ | 46′ 1.2″ | 46′ 4.8″ | 46′ 8.4″ |
| 0.770 | 46′12″ | 46′15.6″ | 46′19.2″ | 46′22.8″ | 46′26.4″ | 46′30″ | 46′33.6″ | 46′37.2″ | 46′40.8″ | 46′44.4″ |
| 0.780 | 46′48″ | 46′51.6″ | 46′55.2″ | 46′58.8″ | 47′ 2.4″ | 47′ 6″ | 47′ 9.6″ | 47′13.2″ | 47′16.8″ | 47′20.4″ |
| 0.790 | 47′24″ | 47′27.6″ | 47′31.2″ | 47′34.8″ | 47′38.4″ | 47′42″ | 47′45.6″ | 47′49.2″ | 47′52.8″ | 47′56.4″ |
| 0.800 | 48′00″ | 48′ 3.6″ | 48′ 7.2″ | 48′10.8″ | 48′14.4″ | 48′18″ | 48′21.6″ | 48′25.2″ | 48′28.8″ | 48′32.4″ |
| 0.810 | 48′36″ | 48′39.6″ | 48′43.2″ | 48′46.8″ | 48′50.4″ | 48′54″ | 48′57.6″ | 49′ 1.2″ | 49′ 4.8″ | 49′ 8.4″ |
| 0.820 | 49′12″ | 49′15.6″ | 49′19.2″ | 49′22.8″ | 49′26.4″ | 49′30″ | 49′33.6″ | 49′37.2″ | 49′40.8″ | 49′44.4″ |
| 0.830 | 49′48″ | 49′51.6″ | 49′55.2″ | 49′58.8″ | 50′ 2.4″ | 50′ 6″ | 50′ 9.6″ | 50′13.2″ | 50′16.8″ | 50′20.4″ |
| 0.840 | 50′24″ | 50′27.6″ | 50′31.2″ | 50′34.8″ | 50′38.4″ | 50′42″ | 50′45.6″ | 50′49.2″ | 50′52.8″ | 50′56.4″ |
| 0.850 | 51′00″ | 51′ 3.6″ | 51′ 7.2″ | 51′10.8″ | 51′14.4″ | 51′18″ | 51′21.6″ | 51′25.2″ | 51′28.8″ | 51′32.4″ |
| 0.860 | 51′36″ | 51′39.6″ | 51′43.2″ | 51′46.8″ | 51′50.4″ | 51′54″ | 51′57.6″ | 52′ 1.2″ | 52′ 4.8″ | 52′ 8.4″ |
| 0.870 | 52′12″ | 52′15.6″ | 52′19.2″ | 52′22.8″ | 52′26.4″ | 52′30″ | 52′33.6″ | 52′37.2″ | 52′40.8″ | 52′44.4″ |
| 0.880 | 52′48″ | 52′51.6″ | 52′55.2″ | 52′58.8″ | 53′ 2.4″ | 53′ 6″ | 53′ 9.6″ | 53′13.2″ | 53′16.8″ | 53′20.4″ |
| 0.890 | 53′24″ | 53′27.6″ | 53′31.2″ | 53′34.8″ | 53′38.4″ | 53′42″ | 53′45.6″ | 53′49.2″ | 53′52.8″ | 53′56.4″ |
| 0.900 | 54′00″ | 54′ 3.6″ | 54′ 7.2″ | 54′10.8″ | 54′14.4″ | 54′18″ | 54′21.6″ | 54′25.2″ | 54′28.8″ | 54′32.4″ |
| 0.910 | 54′36″ | 54′39.6″ | 54′43.2″ | 54′46.8″ | 54′50.4″ | 54′54″ | 54′57.6″ | 55′ 1.2″ | 55′ 4.8″ | 55′ 8.4″ |
| 0.920 | 55′12″ | 55′15.6″ | 55′19.2″ | 55′22.8″ | 55′26.4″ | 55′30″ | 55′33.6″ | 55′37.2″ | 55′40.8″ | 55′44.4″ |
| 0.930 | 55′48″ | 55′51.6″ | 55′55.2″ | 55′58.8″ | 56′ 2.4″ | 56′ 6″ | 56′ 9.6″ | 56′13.2″ | 56′16.8″ | 56′20.4″ |
| 0.940 | 56′24″ | 56′27.6″ | 56′31.2″ | 56′34.8″ | 56′38.4″ | 56′42″ | 56′45.6″ | 56′49.2″ | 56′52.8″ | 56′56.4″ |
| 0.950 | 57′00″ | 57′ 3.6″ | 57′ 7.2″ | 57′10.8″ | 57′14.4″ | 57′18″ | 57′21.6″ | 57′25.2″ | 57′28.8″ | 57′32.4″ |
| 0.960 | 57′36″ | 57′39.6″ | 57′43.2″ | 57′46.8″ | 57′50.4″ | 57′54″ | 57′57.6″ | 58′ 1.2″ | 58′ 4.8″ | 58′ 8.4″ |
| 0.970 | 58′12″ | 58′15.6″ | 58′19.2″ | 58′22.8″ | 58′26.4″ | 58′30″ | 58′33.6″ | 58′37.2″ | 58′40.8″ | 58′44.4″ |
| 0.980 | 58′48″ | 58′51.6″ | 58′55.2″ | 58′58.8″ | 59′ 2.4″ | 59′ 6″ | 59′ 9.6″ | 59′13.2″ | 59′16.8″ | 59′20.4″ |
| 0.990 | 59′24″ | 59′27.6″ | 59′31.2″ | 59′34.8″ | 59′38.4″ | 59′42″ | 59′45.6″ | 59′49.2″ | 59′52.8″ | 59′56.4″ |
| 1.000 | 1°0′0″ | | | | | | | | | |

Note: Continued from MACHINERY's Data Sheet for September, 1959

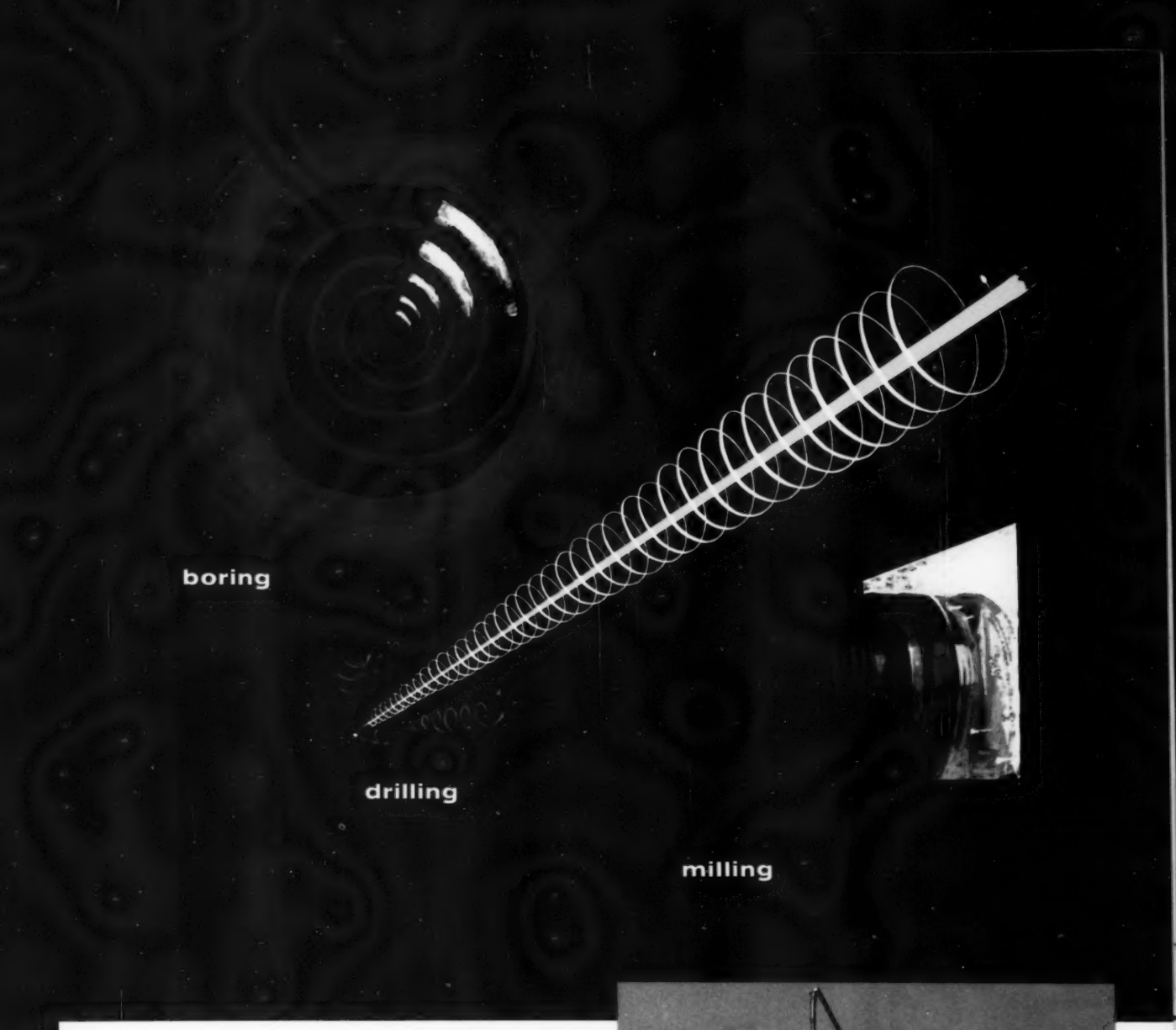
Compiled by D. E. Lewis, Devon, England

## TABLE FOR CONVERTING DECIMALS OF A RADIAN INTO DEGREES, MINUTES, AND SECONDS—1

| Decimal of Radian | 0.000 | 0.001 | 0.002 | 0.003 | 0.004 | 0.005 | 0.006 | 0.007 | 0.008 | 0.009 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.000 | 0°00′00.00″ | 0°03′26.26″ | 0°06′52.53″ | 0°10′18.79″ | 0°13′45.06″ | 0°17′11.32″ | 0°20′37.59″ | 0°24′03.85″ | 0°27′30.12″ | 0°30′56.38″ |
| 0.010 | 0°34′22.65″ | 0°37′48.91″ | 0°41′15.18″ | 0°44′41.44″ | 0°48′ 7.71″ | 0°51′33.97″ | 0°55′ 0.24″ | 0°58′26.50″ | 1°01′52.76″ | 1°05′19.03″ |
| 0.020 | 1°08′45.30″ | 1°12′11.56″ | 1°15′37.83″ | 1°19′04.09″ | 1°22′30.36″ | 1°25′56.62″ | 1°29′22.88″ | 1°32′49.15″ | 1°36′15.41″ | 1°39′41.68″ |
| 0.030 | 1°43′07.94″ | 1°46′34.21″ | 1°50′00.47″ | 1°53′26.74″ | 1°56′53.00″ | 2°00′19.27″ | 2°03′45.53″ | 2°07′11.80″ | 2°10′38.06″ | 2°14′04.33″ |
| 0.040 | 2°17′30.59″ | 2°20′56.86″ | 2°24′23.12″ | 2°27′49.39″ | 2°31′15.65″ | 2°34′41.92″ | 2°38′08.18″ | 2°41′34.45″ | 2°45′00.71″ | 2°48′26.98″ |
| 0.050 | 2°51′53.24″ | 2°55′19.50″ | 2°58′45.77″ | 3°02′12.03″ | 3°05′38.30″ | 3°09′04.56″ | 3°12′30.83″ | 3°15′57.09″ | 3°19′23.36″ | 3°22′49.62″ |
| 0.060 | 3°26′15.89″ | 3°29′42.15″ | 3°33′08.42″ | 3°36′34.68″ | 3°40′00.95″ | 3°43′27.21″ | 3°46′53.48″ | 3°50′19.74″ | 3°53′46.01″ | 3°57′12.27″ |
| 0.070 | 4°00′38.54″ | 4°04′04.80″ | 4°07′31.07″ | 4°10′57.33″ | 4°14′23.60″ | 4°17′49.86″ | 4°21′16.12″ | 4°24′42.39″ | 4°28′08.65″ | 4°31′34.92″ |
| 0.080 | 4°35′01.18″ | 4°38′27.45″ | 4°41′53.71″ | 4°45′19.98″ | 4°48′46.24″ | 4°52′12.51″ | 4°55′38.77″ | 4°59′05.04″ | 5°02′31.30″ | 5°05′57.57″ |
| 0.090 | 5°09′23.83″ | 5°12′50.10″ | 5°16′16.36″ | 5°19′42.63″ | 5°23′08.89″ | 5°26′35.16″ | 5°30′01.42″ | 5°33′27.69″ | 5°36′53.95″ | 5°40′20.22″ |
| 0.100 | 5°43′46.48″ | 5°47′12.74″ | 5°50′39.01″ | 5°54′05.27″ | 5°57′31.54″ | 6°00′57.80″ | 6°04′24.07″ | 6°07′50.33″ | 6°11′16.60″ | 6°14′42.86″ |
| 0.110 | 6°18′09.13″ | 6°21′35.39″ | 6°25′01.66″ | 6°28′27.92″ | 6°31′54.19″ | 6°35′20.45″ | 6°38′46.72″ | 6°42′12.98″ | 6°45′39.25″ | 6°49′05.51″ |
| 0.120 | 6°52′31.78″ | 6°55′58.04″ | 6°59′24.31″ | 7°02′50.57″ | 7°06′16.84″ | 7°09′43.10″ | 7°13′09.36″ | 7°16′35.63″ | 7°20′01.89″ | 7°23′28.16″ |
| 0.130 | 7°26′54.42″ | 7°30′20.69″ | 7°33′46.95″ | 7°37′13.22″ | 7°40′39.48″ | 7°44′05.75″ | 7°47′32.01″ | 7°50′58.28″ | 7°54′24.54″ | 7°57′50.81″ |
| 0.140 | 8°01′17.07″ | 8°04′43.34″ | 8°08′09.60″ | 8°11′35.87″ | 8°15′02.13″ | 8°18′28.40″ | 8°21′54.66″ | 8°25′20.93″ | 8°28′47.19″ | 8°32′13.46″ |
| 0.150 | 8°35′39.72″ | 8°39′05.98″ | 8°42′32.25″ | 8°45′58.51″ | 8°49′24.78″ | 8°52′51.04″ | 8°56′17.31″ | 8°59′43.57″ | 9°03′09.84″ | 9°06′36.10″ |
| 0.160 | 9°10′02.37″ | 9°13′28.63″ | 9°16′54.90″ | 9°20′21.16″ | 9°23′47.43″ | 9°27′13.69″ | 9°30′39.96″ | 9°34′06.22″ | 9°37′32.49″ | 9°40′58.75″ |
| 0.170 | 9°44′25.02″ | 9°47′51.28″ | 9°51′17.55″ | 9°54′43.81″ | 9°58′10.08″ | 10°01′36.34″ | 10°05′02.60″ | 10°08′28.87″ | 10°11′55.13″ | 10°15′21.40″ |
| 0.180 | 10°18′47.66″ | 10°22′13.93″ | 10°25′40.19″ | 10°29′06.46″ | 10°32′32.72″ | 10°35′58.99″ | 10°39′25.25″ | 10°42′51.52″ | 10°46′17.78″ | 10°49′44.05″ |
| 0.190 | 10°53′10.31″ | 10°56′36.58″ | 11°00′02.84″ | 11°03′29.11″ | 11°06′55.37″ | 11°10′21.64″ | 11°13′47.90″ | 11°17′14.17″ | 11°20′40.43″ | 11°24′06.69″ |
| 0.200 | 11°27′32.96″ | 11°30′59.22″ | 11°34′25.49″ | 11°37′51.75″ | 11°41′18.02″ | 11°44′44.28″ | 11°48′10.55″ | 11°51′36.81″ | 11°55′03.08″ | 11°58′29.34″ |
| 0.210 | 12°01′55.61″ | 12°05′21.87″ | 12°08′48.14″ | 12°12′14.40″ | 12°15′40.67″ | 12°19′06.93″ | 12°22′33.20″ | 12°25′59.46″ | 12°29′25.73″ | 12°32′51.99″ |
| 0.220 | 12°36′18.26″ | 12°39′44.52″ | 12°43′10.79″ | 12°46′37.05″ | 12°50′03.31″ | 12°53′29.58″ | 12°56′55.84″ | 13°00′22.11″ | 13°03′48.37″ | 13°07′14.64″ |
| 0.230 | 13°10′40.90″ | 13°14′07.17″ | 13°17′33.43″ | 13°20′59.70″ | 13°24′25.96″ | 13°27′52.23″ | 13°31′18.49″ | 13°34′44.76″ | 13°38′11.02″ | 13°41′37.29″ |
| 0.240 | 13°45′03.55″ | 13°48′29.82″ | 13°51′56.08″ | 13°55′22.35″ | 13°58′48.61″ | 14°02′14.88″ | 14°05′41.14″ | 14°09′07.41″ | 14°12′33.67″ | 14°15′59.93″ |
| 0.250 | 14°19′26.20″ | 14°22′52.47″ | 14°26′18.73″ | 14°29′45.00″ | 14°33′11.26″ | 14°36′37.53″ | 14°40′03.79″ | 14°43′30.06″ | 14°46′56.32″ | 14°50′22.58″ |
| 0.260 | 14°53′48.85″ | 14°57′15.11″ | 15°00′41.38″ | 15°04′07.64″ | 15°07′33.91″ | 15°11′00.17″ | 15°14′26.44″ | 15°17′52.70″ | 15°21′18.97″ | 15°24′45.23″ |
| 0.270 | 15°28′11.49″ | 15°31′37.76″ | 15°35′04.03″ | 15°38′30.29″ | 15°41′56.56″ | 15°45′22.82″ | 15°48′49.09″ | 15°52′15.35″ | 15°55′41.62″ | 15°59′07.88″ |
| 0.280 | 16°02′34.15″ | 16°06′00.41″ | 16°09′26.68″ | 16°12′52.94″ | 16°16′19.20″ | 16°19′45.47″ | 16°23′11.73″ | 16°26′38.00″ | 16°30′04.26″ | 16°33′30.53″ |
| 0.290 | 16°36′56.79″ | 16°40′23.06″ | 16°43′49.32″ | 16°47′15.59″ | 16°50′41.85″ | 16°54′08.12″ | 16°57′34.38″ | 17°01′00.65″ | 17°04′26.91″ | 17°07′53.18″ |
| 0.300 | 17°11′19.44″ | 17°14′45.71″ | 17°18′11.97″ | 17°21′38.24″ | 17°25′04.50″ | 17°28′30.77″ | 17°31′57.03″ | 17°35′23.30″ | 17°38′49.56″ | 17°42′15.82″ |
| 0.310 | 17°45′42.09″ | 17°49′08.35″ | 17°52′34.62″ | 17°56′00.88″ | 17°59′27.15″ | 18°02′53.41″ | 18°06′19.68″ | 18°09′45.94″ | 18°13′12.21″ | 18°16′38.47″ |
| 0.320 | 18°20′04.74″ | 18°23′31.00″ | 18°26′57.27″ | 18°30′23.53″ | 18°33′49.80″ | 18°37′16.06″ | 18°40′42.33″ | 18°44′08.59″ | 18°47′34.86″ | 18°51′01.12″ |
| 0.330 | 18°54′27.38″ | 18°57′53.65″ | 19°01′19.97″ | 19°04′46.18″ | 19°08′12.44″ | 19°11′38.71″ | 19°15′04.97″ | 19°18′31.24″ | 19°21′57.50″ | 19°25′23.77″ |
| 0.340 | 19°28′50.03″ | 19°32′16.30″ | 19°35′42.56″ | 19°39′08.83″ | 19°42′35.09″ | 19°46′01.36″ | 19°49′27.62″ | 19°52′53.89″ | 19°56′20.15″ | 19°59′46.42″ |
| 0.350 | 20°03′12.68″ | 20°06′38.95″ | 20°10′05.21″ | 20°13′31.48″ | 20°16′57.74″ | 20°20′24.00″ | 20°23′50.27″ | 20°27′16.53″ | 20°30′42.80″ | 20°34′09.06″ |

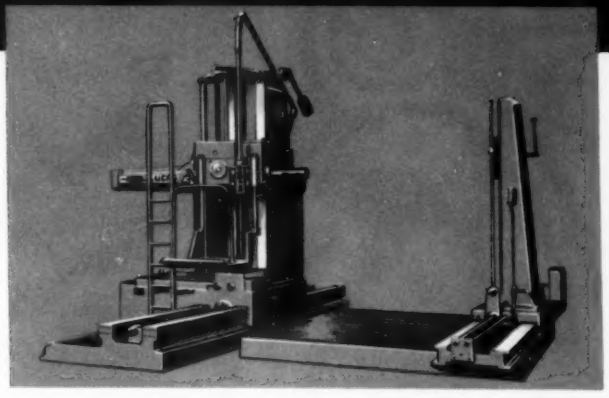
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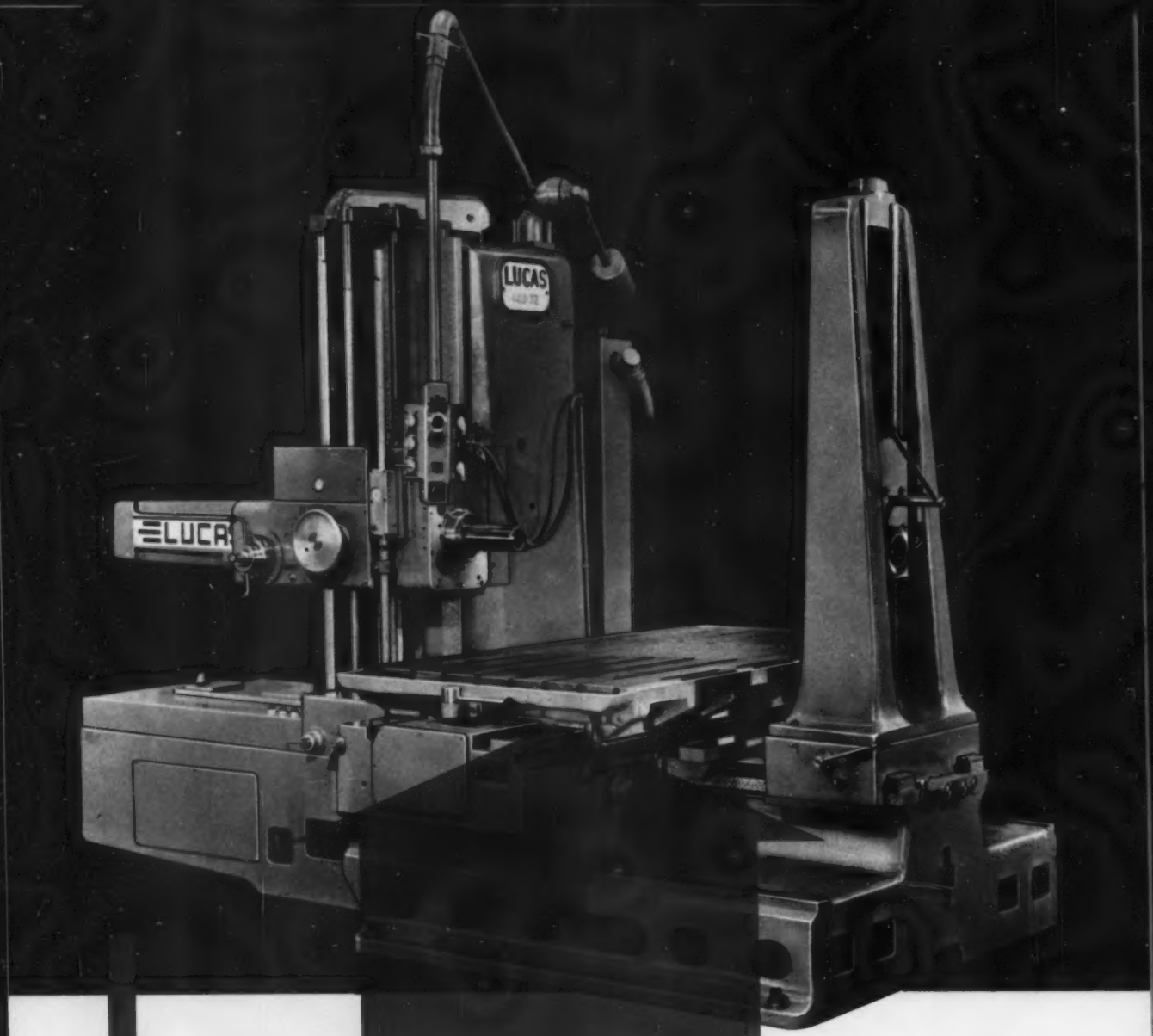



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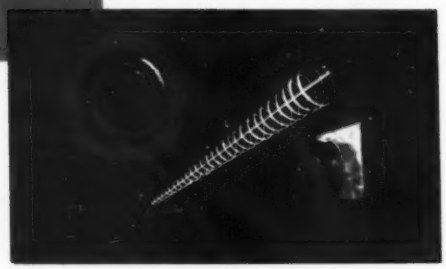



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## NEW CATALOGUES

**CONTROLLED AIR POWER**—Bellows Co., Akron Ohio. Brochure entitled "A Panorama of Production Ideas," giving examples of the ways in which the company's air-motor and other "Controlled-Air-Power" work units are used to cut costs, increase productivity per machine and per man-hour, improve quality, reduce scrap, and prolong tool life. The brochure also describes a number of helpful services available from the company. A copy will be sent on receipt of letterhead request or publication inquiry to the Bellows Co., 228 W. Market St., Akron 9, Ohio.

**REPLACEMENTS**—Meehanite Metal Corporation, New Rochelle, N. Y. Bulletin No. 37, entitled "Proof That Meehanite Bridges the Gap." Included are alphabetical tabulations showing specific replacements of alloyed irons, steels, brass, bronze, and forgings as well as type of Meehanite metal used in such applications. Copies may be obtained per request on company letterhead from Meehanite Metal Corporation, 714 North Ave., New Rochelle, N. Y.

**BAR AUTOMATICS**—National Acme Co., Cleveland, Ohio. 44-page catalogue MSB-59, illustrating and describing the company's complete line of multiple-spindle bar automatics. To obtain copies, write on your company letterhead, giving name and title, to National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.

**INDUSTRIAL GASES**—Air Reduction Sales Co., a division of Air Reduction Co., Inc., New York City. Catalogue ADC 892, a 32-page illustrated booklet containing a comprehensive survey of the production and commercial applications of all currently available industrial gases. One section is devoted to systems for gaseous or liquid delivery and storage available from Air Reduction. A conversion data table and a table on properties of the gases are included. . . . . **501**

**AIR CONTROL VALVE**—Cleveland Pneumatic Industries, Skokie, Ill. Two bulletins describing a line of Revco-Aire hand-, foot-, and solenoid-actuated air control valves. Bulletin 8100 illustrates disc type valves from 1/4- through 1-inch pipe sizes and a complete line of pilot-operated valves from 1/4- through 3/4-inch pipe sizes. Bulletin 8101 describes the "Designer" series of 1/8- through 1/2-inch valves that are recommended for direct actuation of small cylinders and for use as pilot valves in sequence circuits. . . . . **502**

**ABRASIVE WHEELS**—Carborundum Co., Niagara Falls, N. Y. 57-page specifications catalogue presenting over 1600 experience-tested abrasive-wheel recommendations for grinding everything from agate to zirconium. Recommendations on abrasive, grit, grade, and bond for various operations on different materials are listed for quick reference. A limited number are available for general distribution on a first-come, first-served basis. . . . . **503**

**METAL CLEANING**—Oakite Products, Inc., New York City. Handbook entitled "Some More Good Things to Know About Metal Cleaning," containing information developed over the company's fifty years of pioneering in the metal cleaning and treating fields. The booklet discusses the

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chemistry and techniques of cleaning; tank cleaning, with suggestions for tank design and layout and selection of detergents; electrocleaning; barrel cleaning; machine cleaning; and ultrasonic cleaning. .....504

**BELLOWS**—Belfab Corporation, Hamden, Conn. Bellows-design slide rule, as well as a manual containing advanced mathematical formulas enabling design engineers to compute reasonable design parameters for welded metal bellows, for use as volumetric expansion devices, pressure sensors, rotary and linear seals, aneroids, stem seals, expansion joints, gimbal joints, etc. .....505

**PORTABLE TOOLS**—Rotor Tool Co., Cleveland, Ohio. 90-page booklet entitled "How To Choose and Use Portable Air Tools." The basic objective of the handbook is to help get more productivity from portable tools and thus cut costs. One article, "Power Tools for Tightening Threaded Fasteners," suggests a somewhat different approach to assembly operations than heretofore considered. .....506

**PRECISION INSTRUMENT COMPONENTS**—Pic Design Corporation, East Rockaway, N. Y. 416-page master catalogue No. 20a, listing over 10,000 items, including gears, shafts, collars, couplings, speed reducers, differentials, and other precision items available from stock. In addition to detailed drawings, complete specifications, and prices, the catalogue contains separate technical data, a breadboard kit, and a precision tool components section. .....507

**TUBING**—Babcock & Wilcox, New York City. Folder TB-430, entitled "How to Cut Cost by Using Alloy Mechanical Tubing," discussing initial cost, structural advantages of tubing, fabrication by machining, types of steel, types of tubes, and procurement information—all of which, when employed properly, can help manufacturers cut costs of hollow precision parts. .....508

**CARBIDES**—Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Revised catalogue called "Carmet Catalog C-16-B," containing a number of important changes over material previously distributed: reduction of base prices of standard Carmet unground blanks, brazed tools, indexable inserts, quantity extras on all standard products, and maximum quantities—as well as additions to the Carmet standard product line. .....509

**PRECISION MEASURING INSTRUMENTS**—Testing Machines, Inc., Mineola, N. Y. Three brochures covering precision motorized and manually operated deadweight micrometers for the most accurate measurement of paper, film, foil, and rubber sheet materials, according to rigid ASTM and government specifications. .....510

**MOTORS AND GENERATORS**—Imperial Electric Co., Akron, Ohio. Bulletin entitled "Electric Motors and Generators . . . A-C and D-C." Included are squirrel-cage A.C. motors, special-purpose motors, wound-rotor motors, direct-current motors and generators, and motor-generator sets. .....511

**LATHES**—Farrel-Birmingham Co., Inc., Consolidated Machine Tool Division, Rochester, N. Y. Bulletin 1217, describing the new line of Farrel-Betts roll lathes which can be arranged for either hydraulic or electric contouring. They can also be furnished for plain turning with a wide range of feeds. .....512

**ELECTRONIC TRACER**—Linde Company, Division of Union Carbide Corporation, New York City. Booklet (Form 1287) describing how simple pencil line sketches of intricate shapes and forms can now be used to guide oxygen shape-cutting machines with a new electronic tracer known as the Linde Photocell Tracer. 513

**TOOL STEELS**—Uddeholm Co. of America, Inc., New York City. 28-page booklet entitled "Modern Principles of Heat Treatment of Steel," describing the derivation and meaning of the "TTT" diagram and providing fundamental information concerning various heat-treating procedures including step-annealing, martempering, and austempering. .....514

**COLD-HEADING WIRE**—Scovill Mfg. Co., Waterbury, Conn. Bulletin describing applications and advantages, and listing available stock tempers of extruded cold-heading wire (cartridge brass, 70 per cent). It also gives characteristics of the material, as well as specifications. .....515

**SWITCHES**—Micro Switch, Freeport, Ill. Catalogue No. 63, titled "Small Basic Switches," covering four important Micro Switch groups—Type "V3" postage-stamp-sized switches; Type "TB" two-circuit switches; Type 1SX1 sub-subminiature switches; and Type "SM" subminiature switches. Typical auxiliary actuators and assemblies are shown with each of the four types. .....516

**MILLING CUTTERS**—Morse Twist Drill & Machine Co., New Bedford, Mass. Nomograph showing how to determine the performance of circular milling cutters. The three-color chart is a punched fold-out designed for ringbinder insert that graphically shows cutting standards for circular milling cutters when applied to various metals and plastics. .....517

**GRINDERS**—Landis Tool Co., Waynesboro, Pa. Bulletin MF-59, describing the company's new wheel feed, called "Microfeed," an ultra-fine feed to finish size that cancels grinding feed variables common to all cylindrical-grinder feed systems. .....518

**IN-LINE ACCESSORIES**—Airmatic Valve, Inc., Cleveland, Ohio. Bulletin 91021, describing Airmatic in-line accessories—pressure regulators, strainers, flow control valves, sequence valves, and quick-exhaust valves. .....519

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| 507 | 518 | 529 | 540 | 551 | 562 | 573 | 584 | 595 | 606 | 617 | 628 |
| 508 | 519 | 530 | 541 | 552 | 563 | 574 | 585 | 596 | 607 | 618 | 629 |
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**GRINDING-WHEEL BALANCER**—Aero Supply Mfg. Co., Inc., Corry, Pa. Bulletin 2260, describing a fast and accurate method of balancing grinding wheels with simple portable equipment offering time savings up to 80 per cent. . . . **520**

**HEAT-TREATMENT**—Ipsen Industries, Inc., Rockford, Ill. Bulletin (T-19-C) entitled "The Facts on the New Ipsen Heat Treating Units," giving detailed construction and performance facts on the equipment which operates at temperatures up to 2000 degrees F. . . . . **521**

**BORING AND FACING TOOLS**—Comet Tool Co., New York City. Brochure presenting precision-boring, facing, and internal threading tools, featuring "solid-carbide insert" boring tools as well as complete jig-boring sets. . . . . **522**

**DRIVES**—Reliance Electric & Engineering Co., Cleveland, Ohio. Bulletin D-2507, giving performance and application data on the company's complete line of all-electric, adjustable-speed "V*S Jr." drives, covering typical applications from 1/8 through 4 hp. . . . . **523**

**RUBBER PARTS**—Garlock Packing Co., Palmyra, N. Y. Bulletin AD-167, describing various types of molded and extruded rubber parts for use on automobiles, aircraft, machinery, appliances, and office and railroad equipment. . . . . **524**

**BARREL FINISHING**—Roto-Finish Co., Kalamazoo, Mich. Brochure describing the Roto-Finish Vibratron precision finishing machine. Included is a diagram illustrating how the action of the Vibratron differs from conventional barrel-finishing equipment. . . . . **525**

**HOSE FITTING**—Parker-Hannifin Corporation, Cleveland, Ohio. Catalogue No. 4482, featuring a new line of easy-to-assemble fittings and industrial hose for air, water, oil, and fuel service at pressures under 250 psi. The fittings have been given the trade name of "Push-lok." . . . . **526**

**THREAD-ROLLING** — Landis Machine Co., Waynesboro, Pa. Bulletin E-101, pertaining to the thread-rolling machine, the Lan-Nu-Rol. It describes the Lan-Nu-Rol's specifications and capacities and includes design and operating features. . . . . **527**

**TITANIUM**—Titanium Metals Corporation of America, New York City. 32-page manual entitled "Titanium Machining Techniques," a comprehensive study of successful machining practices under current operating conditions. **528**

**TOOL PRODUCTIVITY**—Jones & Lamson Machine Co., Springfield, Vt. Booklet (second revised edition) describing the J & L "Avoidable Costs" Replacement Formula, an improved method for appraising the productivity of machine tools and similar capital equipment. . . . . **529**

**C-CLAMPS**—Wilton Tool Mfg. Co., Inc., Schiller Park, Ill. Condensed catalogue No. 707, featuring C-clamps and giving details of their construction. It describes the company's "Fire Bath" process used to harden frames, spindles, and handles. . . . . **530**

**COMPRESSED AIR**—Ingersoll-Rand Co., Phillipsburg, N. J. Booklet entitled "Compressed Air Fundamentals," giving information concerning the selection of a small "packaged" air compressor for either automotive or industrial application. . . . . **531**

**ELECTROMAGNETIC CLUTCHES**—I-T-E Circuit Breaker Co., Philadelphia, Pa. Bulletin 6304-1B, giving detailed information on the company's complete line of electromagnetic clutches, "Electro Clutches," in six series with torque capacities from 1.8 through 13,000 pound-feet. . . . . **532**

**ARMATURE ASSEMBLY**—Warner Electric Brake & Clutch Co., Beloit, Wis. Brochure P-68, describing a new armature drive for heavy-duty applications. Included are sections on operation, dimensions, replacement parts, and installation. . . . . **533**

**TUBE SELECTOR**—Scovill Mfg. Co., Waterbury, Conn. Folder providing a complete listing, with applicable specifications and typical uses, of the company's general commercial tube products. **534**

**NITRIDING**—A. F. Holden Co., Detroit, Mich. Bulletin No. 204, describing a recently developed liquid pressure nitriding process, tested and passed by the firm's research laboratories. . . . . **535**

**SURFACE PROCESSING**—Ransohoff Co., Hamilton, Ohio. 40-page catalogue presenting machinery and machinery systems for metal surface processing (cleaning, washing, rinsing, drying and spraying, flow and dip coating). . . . . **536**

**MAGNETIC STARTERS**—Furnas Electric Co., Batavia, Ill. Catalogue 14-B1, introducing a line of magnetic starters through 15 hp 440-550 volts. . . . . **537**

**COUPLINGS**—Dodge Mfg. Corporation, Mishawaka, Ind. Bulletin A669C, de-


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scribing an expanded line of Dodge Paraflex flexible cushion couplings ranging from fractional to 190 hp per 100 rpm. .....538

**CYLINDRICAL GRINDING WHEELS**—Macklin Co., Jackson, Mich. Brochure presenting the desired characteristics of cylindrical grinding wheels. .....539

**REPLACEMENT**—Heald Machine Co., Worcester, Mass. Replacement Analysis Manual presenting information on the importance of a planned replacement program, including an analysis form and bibliography. .....540

**SPINDLES**—Bryant Chucking Grinder Co., Springfield, Vt. Catalogue describing high-frequency spindles, motorized spindles, and built-to-order induction motors. .....541

**DRILL-POINT GRINDER**—Morse Twist Drill & Machine Co., New Bedford, Mass. Folder describing the features of a production drill-point grinder. .....542

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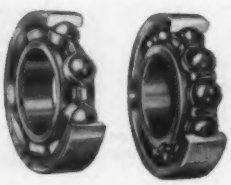

New Caterpillar D8 Series H Tractor

# Performance-proved in big Cat-built Tractors...Fafnir Ball Bearings!

Where Caterpillar goes, Fafnir Ball Bearings go, too. They've helped carry the load in Caterpillar equipment for 39 years.

In the steering clutch of the new 23½ ton D8 Series H Tractor, for example, Fafnir Ball Bearings help provide easy, precise control. They are also used in the bulldozer cable control system, to insure smooth, dependable performance under brutal shock loads.

If your requirements call for bearings engineered for heavy equipment, let Fafnir help you. You'll find breadth of line and experience that assure precise answers. The Fafnir Bearing Company, New Britain, Connecticut.



In the Caterpillar D8 Tractor, Fafnir non-filling slot type ball bearings (left) take combined radial and heavy thrust loads, and filling-slot type bearings (right) take combined thrust and heavy radial loads. Both types are widely used in heavy equipment.

**FAFNIR**
**BALL BEARINGS**

tures are available for grinding drill points with angles of less than 118 degrees and for extending the drill-length range to 12 inches. In addition, attachments are available for split-pointing and helicentric pointing at production rates.

All grinding is done wet, using an integral coolant pump. The machine has an extra-large receiving tray that keeps work handling to a minimum, and prevents coolant splashing.

All parts subject to wear are hardened and ground, the cartridge type wheel spindle is interchangeable, and all components are standard. The unit is 2 feet wide, 3 feet deep, and 4 feet high. It is equipped with a 1/2-hp, 220/440-volt, three-phase motor.

**Circle Item 593 on postcard, page 215**

## Hydraulic Feed Control for Burgmaster Automatic Turret Drilling Machines

The Burg Tool Mfg. Co., Gardena, Calif., has announced an improved hydraulic feed for its Models 2 BH and 3 BH automatic hydraulic turret drilling machines. The new system compensates for temperature variations that normally affect feed rates when hydraulic systems are employed. The temperature-compensated oil-flow control is designed to maintain constant feed rates under normal operating conditions. It enables feed rates to be dial calibrated so that reliable settings can be made. Thus, the actual feed rate always corresponds with the feed-rate setting within normal temperature ranges. Previously, it was necessary to readjust the feed setting as the machine warmed up after standing idle. No hydraulic warm-up time is now required, feed selection is simplified, and the chances of an erratic feed setting are greatly minimized.

These "Burgmaster" turret drilling machines are equipped with the improved temperature-compensating hydraulic system. Machines previously installed can also be equipped with this control. If desired, the change-over can be made with a do-it-yourself kit containing complete instructions and assemblies.

**Circle Item 594 on postcard, page 215**



Burgmaster 3 BH automatic turret drilling machine with positioning table and General Electric numerical control



Wells large-capacity band saw

## Horizontal Metal-Cutting Band Saw

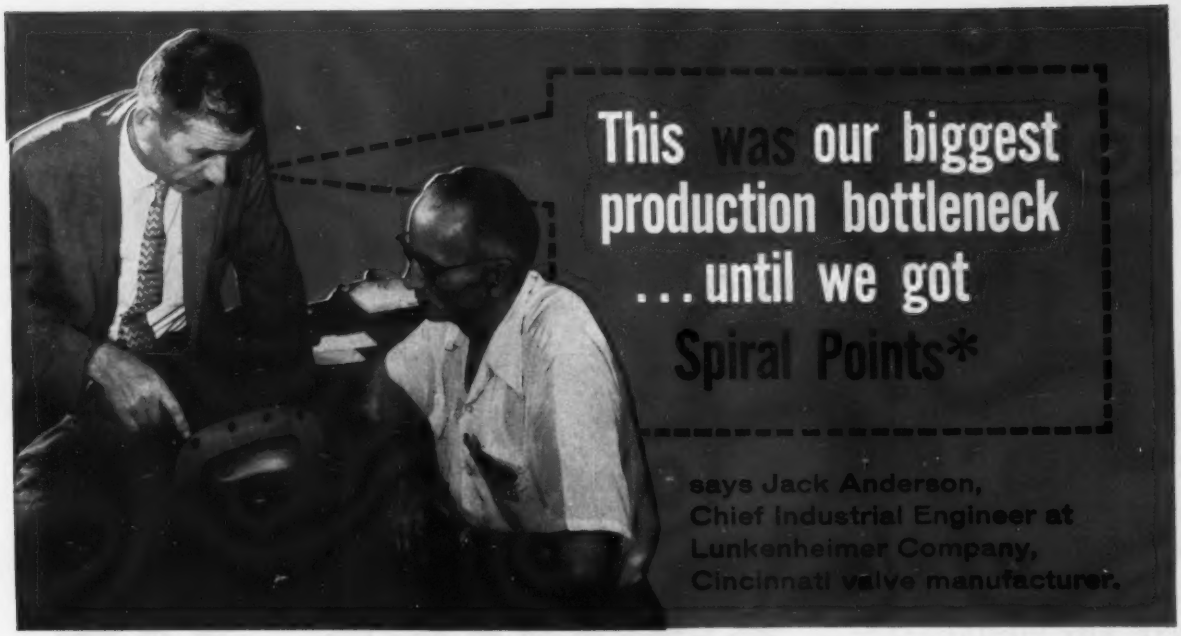
W. F. Wells & Sons, Three Rivers, Mich., has announced a horizontal metal-cutting band saw designated the X-60. This equipment has been specially developed for cutting a wide variety of materials where a large-capacity machine with restricted length of cut is required. It will cut off pieces up to a maximum length of 18 inches from work-pieces 60 by 60 inches. The frame columns are large box sections with replaceable guide rail. The cutting head is raised by two hydraulic cylinders, one at each side of the frame. This feature is said to minimize vibration and assure correct alignment.

The cutting head rolls on a heavy guide rail equipped with ball-bearing rollers. Variable-speed drive, infinitely adjustable from 60 to 300 feet per minute, provides the exact speed required for any material. The operator dials the desired speed in complete safety while the machine is in operation. Panel-mounted controls are conveniently located.

The X-60 weighs 3000 pounds, is 103 inches wide, 49 inches front-to-back, and 107 inches high. A saw blade 20 feet 10 inches long, 1 1/4 inches wide, and 0.035 inch thick is used.

**Circle Item 595 on postcard, page 215**

*(This section continued on page 224)*



# This was our biggest production bottleneck ... until we got Spiral Points*

says Jack Anderson, Chief Industrial Engineer at Lunkenheimer Company, Cincinnati valve manufacturer.

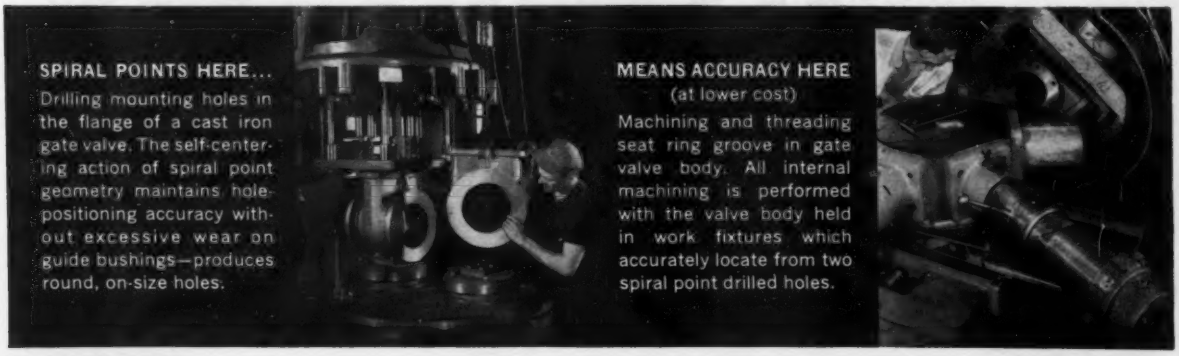
"Just two of these holes are critical—all other machining operations are located from them. But it used to cost us plenty to get them right — frequent drill resharpening, slower feeds, touching up the holes, even special locating pins and eccentric guide bushings.

"It sounds like a miracle, but our spiral point drills broke this production bottleneck completely! They maintained consistent hole size, well within our plus .005" minus .004" tolerance. They don't walk, so guide bushing wear has been practically eliminated. And, where we used to get 225 to 250 parts per drill grind, we now average 2000 or better.

"In short, they drill holes where we want them, to the size we want them . . . in one pass. Now production stays on schedule . . . scrap is negligible."

**Spiral point is Cincinnati's new drill point geometry which transforms a standard twist drill into a cost-reducing, precision tool. Cincinnati's SPIROPOINT® DRILL SHARPENER automatically applies this new point geometry in a matter of seconds.*

ASK YOUR CINCINNATI LATHE AND TOOL CO. DEALER, OR WRITE TO US DIRECT.



SPIRAL POINTS HERE...
Drilling mounting holes in the flange of a cast iron gate valve. The self-centering action of spiral point geometry maintains hole-positioning accuracy without excessive wear on guide bushings—produces round, on-size holes.

MEANS ACCURACY HERE
(at lower cost)
Machining and threading seat ring groove in gate valve body. All internal machining is performed with the valve body held in work fixtures which accurately locate from two spiral point drilled holes.

Improved Machining Through Research

## CINCINNATI LATHE AND TOOL CO.

3207 Disney Street • Cincinnati 9, Ohio

*"TRAY-TOP" Lathes / "CINCINNATI" Drilling Machines / "SPIROPOINT" Drill Sharpeners*



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Announced by DENISON

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# PACING THE PRESS INDUSTRY WITH...

## 7 major advancements made on an already efficient producer

NOW STANDARD ON THE NEW SERIES "R", "S" AND "T" bench-type presses to cut costs in even your toughest production job.

**PRODUCES MORE PIECES-PER-HOUR** ... 65% faster approach. Faster return speeds on the hydraulic ram give you more cycles-per-minute.

**FASTER TO SET-UP** ... new, quick, simple adjustment now sets position of ram in seconds. And you can "inch" the ram to the work under set pressure. Closer control of ram pressure is quickly attained with a newly developed relief valve.

**SIMPLER TO TOOL** ... there's more daylight to mount tools for manual or automatic production.

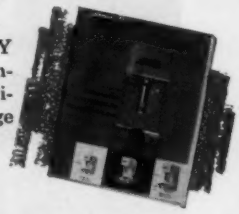
**HANDLES WIDER RANGE OF WORK** ... ram stroke has been doubled for greater tool clearance for long, deep work.

**EASIER TO OPERATE** ... there's more knee room for operator's convenience.

**SIMPLER TO MAINTAIN** ... complete motor and pump swing out of position to inspect and service the hydraulic system.

**BUILT TO J.I.C. STANDARDS**

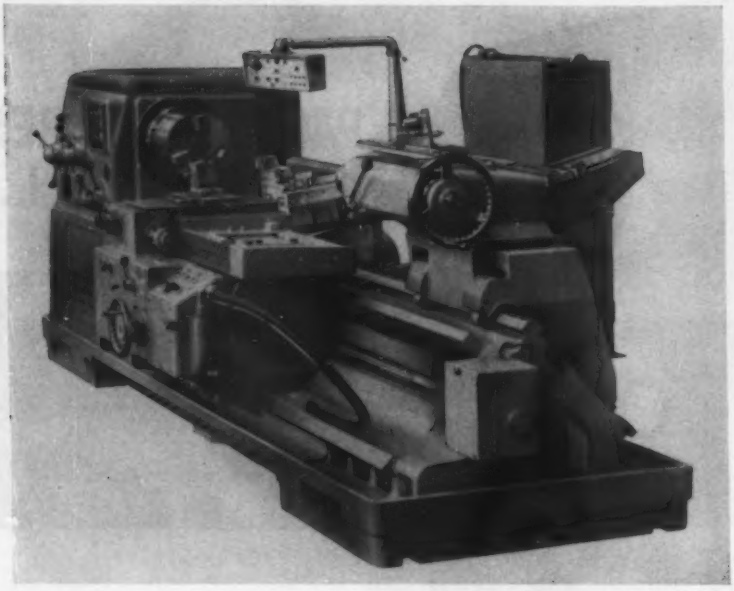
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"Cri-Dan" Type "FT 80" machine made available by Gisholt Machine Co.

## "Cri-Dan" Machine Incorporating Features of Automatic Cycle Tracing Lathe and Threading Machine

The Gisholt Machine Co., Madison, Wis., has announced the addition of a Type "FT 80" machine to its line of Cri-Dan equipment. This equipment is said to have characteristics that are slightly superior to those of the Cri-Dan "E" model. It incorporates the advantages of an automatic-cycle tracing lathe and a threading machine and was shown for the first time at the Sixth European Machine Tool Exhibition in Paris last month. A double bed makes possible semi-automatic or automatic cycle threading and tracing in one operation. The machine is especially adapted for use in shops engaged in medium- and heavy-production pipe work.

Circle Item 596 on postcard, page 215

## Miniature Grinding Gage

A small-size, continous grinding gage (Model SG) has been added to the line manufactured by the Arnold Gauge Co., Flint, Mich., and distributed solely by Federal Products Corporation, Providence, R. I. The calipers regularly furnished with the miniature gage are adjustable from 0.093 to 0.500 inch. Calipers as small as 0.060 inch can be furnished for some applications.

A Federal dial indicator is provided for work size indication or a Federal "AirProbe" may be installed on the same frame for automatic air-electric size control. High-magnification air gaging is also available by using an AirProbe connected directly to a dimensional air gage.

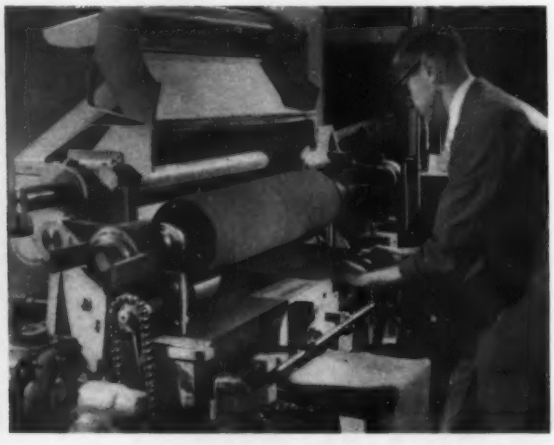
Circle Item 597 on postcard, page 215

## "Bear" Abrasive Wheels Give Unique Finishes

Completely new forms of abrasives are employed in a line of "Bear" wheels and rolls of nonwoven nylon fiber developed by the Behr-Manning Co., Troy, N. Y., a division of the Norton Co. The abrasive grain is dispersed throughout these wheels and rolls, which are intended for finishing and polishing metal, plastics, rubber, and wood materials. The wheels are especially suited for such operations as cleaning, the development of decorative straight-line or swirl patterns, and the imposition of matte finishes where high reflective surfaces are undesirable. They are not designed for stock removal or even for normal grinding or deburring, although their action may be var-



Arnold continuous grinding gage retracted by finger grip to permit placing calipers on work



"Bear" abrasive wheel 38 inches wide applied to the polishing of copper sheet



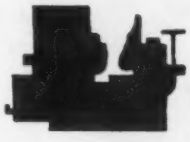
# POSITIVE DUPLICATION – EVERY TIME!



(PD) ° Distinctive bullet markings occur every time a bullet leaves the same gun barrel. The barrel rifling grooves the slug, making possible *positive identification*—an important contribution to the science of ballistics.

## WHEELS MATCHED TO MACHINE

Just as a bullet is matched to a gun barrel, so CINCINNATI (PD) CENTERLESS WHEELS (like those shown above) are matched to your centerless grinding jobs. Thirty-five years of centerless grinding experience back up each application of CINCINNATI (PD) WHEELS to your operation.



## PRECISION PERFORMANCE

And every time—time after time—when you reorder a CINCINNATI (PD) WHEEL, it will act and grind exactly like the original. The Positive Duplication of wheel grades by the remarkable (PD) manufacturing process *will help maintain your production*—and save you both time and money.

Whatever CINCINNATI (PD) WHEEL you specify . . . centertype, centerless, internal, surface, toolroom, or snagging wheel . . . you get Positive Duplication—every time!

## APPLICATION BY SPECIALISTS

Here's another advantage for you. Each one of our factory representatives is a highly trained and experienced specialist in grinding machine set-ups and operations. For his help on those extra-tough grinding problems, call your CINCINNATI (PD) GRINDING WHEEL distributor, or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

(PD) POSITIVE DUPLICATION

CINCINNATI®

GRINDING WHEELS

° Trade Mark Reg. U. S. Pat. Off.

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.



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ied by changing the type and size of grit, modifying the resins used, altering the density of the wheel itself, varying the rate and extent of oscillation, or changing pressures and speeds.

The wheels are made in all normal diameters, in faces widths up to 60 inches and in a grit range from 100 to 600. Cool operation which prevents warping of metals or blistering of foil-clad plastic panels, long life, ease of redressing, and light weight appear to be the chief advantages of these wheels. They should be run at relatively low speeds—approximately 2600 surface feet per minute. Pressures should be light in order to avoid heating, and the wheels should be oscillated to produce the most consistent overall pattern.

Typical work now being performed successfully includes polishing stainless-steel sheet and producing satin finishes on flat sheets of ferrous and non-ferrous metals.

**Circle Item 598 on postcard, page 215**

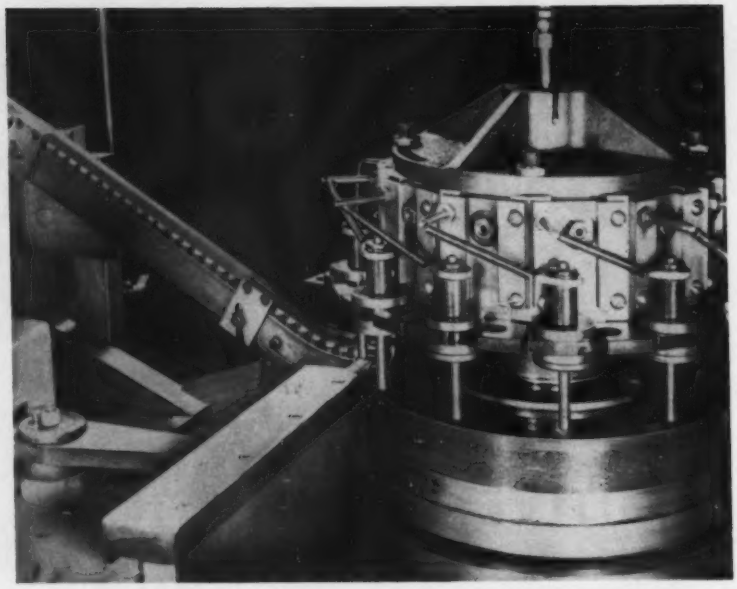


Fig. 1. Close-up of mandrel head of Prutton Model 300 planetary thread roller

## Tubela Bending Machine

The Wallace Supplies Mfg. Co., Chicago, Ill., is introducing a precision-built Tubela pipe-bending machine of exceptionally rugged, all-steel construction. A pressure of 8 tons is developed by this press through the manual hydraulic pump. The bending dies are all finished to a close fit on the pipe to assure high-quality bends. A rapid power-actuated return stroke withdraws the work from the tight-fitting dies.

The machine and six sets of bending dies for 1/2-, 3/4-, 1-, 1 1/4-, 1 1/2-, and 2-inch pipe (made to iron-pipe standards) plus a straightening shoe come packed in a strong metal case.

**Circle Item 599 on postcard, page 215**




Tubela bending machine introduced by Wallace Supplies Mfg. Co.

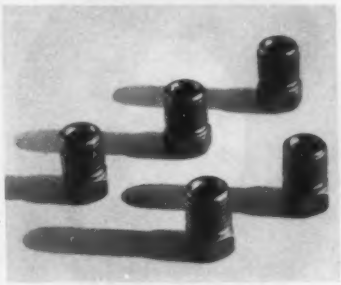


Fig. 2. Hollow tube nuts blanked out on nut-forming machine and threaded on Prutton equipment illustrated in Fig. 1

## Prutton Planetary Thread Roller

External threads are being applied to 5/16-inch hollow tube nuts by a Prutton Model 300 planetary thread roller at the rate of 9000 pieces per hour. This thread roller, built by the Prutton Corporation, Cleveland, Ohio, enables Hi-Vol Products, Detroit, Mich., to make very large reductions in production costs as well as the cost of the part material. Forty-five pounds of expensive straightened and cut hex stock was originally used to manufacture one thousand 5/16-inch tube nuts like the ones shown in Fig. 2. The machining operations when using the

*(Continued on page 228)*




*Station where gear case is tipped up 90° on Snyder convertible transfer machine processing 80 cases per hour.*

# How European Quality Car Builder Snyderizes for the Soaring Sixties

This new 53-station transfer machine combines special purpose efficiency with high convertibility for later changes. Part orienting devices enable Snyder to utilize standard horizontal way-type units to drill, spotface, chamfer, ream, line-ream, mill and bore this cast iron standard gear transmission case on all faces. The cases are turned 90° at the thirteenth station and tipped up 90° at the thirty-eighth station, which eliminates vertical machining units. The part is specifically located on faces not subject to future design changes, thus reducing future capital expenditure.

★ ★ ★

Let us show *you* how to SNYDERIZE FOR THE SOARING SIXTIES for more efficient parts handling, gaging, assembly and machining. Send or phone for new brochure with resume of Snyder machines engineered for profit improvement.

**Standard Features of Snyder Machines**

1. SNYDER SELF-CONTAINED UNITS and other units equipped with hardened and ground steel ways.
2. Threading and tap heads equipped with individual lead-screw spindles.
3. Minimum downtime for tool changes because spindles are arranged for pre-set cutting tools.
4. Automatic lubrication.
5. J.I.C. Standards throughout.
6. Electrical interlocks and full depth circuit throughout.
7. Panels equipped with SNYDER CIRCUIT SLEUTH.

# SNYDER CORPORATION

*(Formerly Snyder Tool & Engineering Company)*

3400 E. LAFAYETTE—DETROIT 7, MICHIGAN
Phone: LO 7-0123



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hex stock had to be performed on screw machines.

The Prutton thread roller equipped with the mandrel head seen in the close-up, Fig. 1, made it possible to produce the same number of tube nuts from only 20 pounds of comparatively inexpensive coiled stock. In this case the hollow tube nuts were blanked out on a nut-forming machine. The Prutton Model 300 thread-rolling machine is said to have production speeds as high as 18,000 pieces per hour and a slow die speed of only 164 feet per minute. The slow die speed naturally results in long die life.

Other Prutton machines have production capacities as high as 48,000 pieces per hour and can roll threads on screws, bolts, and nails. The Prutton Planetary Die System can also be used to do roll-forming, marking, serrating, and necking work.

**Circle Item 600 on postcard, page 215**

## Davis Tool Simplifies Machine Alignment

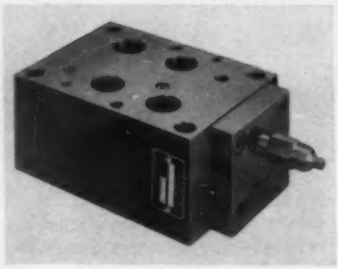
A means for simplifying vertical alignment of machine tools is provided by the Davis "Tru-Plumb" tool. It is made by Davis Boring Tool Division, Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. The unit is an accurate, machined-steel column mounted on a base 17 inches in diameter. Placed on a machine tool table, it serves as a reference for checking alignment of vertical and horizontal spindles, headstocks, columns, end supports, and other machine components by means of dial indicators. Tru-Plumb tools are available in 36-, 48-, and 60-inch heights with a guaranteed accuracy of 0.0002 inch per foot of length.

**Circle Item 601 on postcard, page 215**

## Head Drills Angular and Straight Holes

The Thiftmaster Products Corporation, Lancaster, Pa., recently built a special fixed-center, ball-bearing type drill head designed to drill holes at an angle at the same time straight holes are being drilled parallel to the direction of the machine feed. The ten spindles are equally spaced in two straight rows. To permit the drilling of all holes radially, each pair of spindles is located at an 11-degree angle with the adjacent pair. An included angle of 44 degrees exists between the pairs of outside spindles.

In operation the main body of this head remains stationary while the spindles are being fed into the work through a linkage arrangement by the upper casting attached to the drilling machine. The head is equipped with two guide rods and a machined pad to provide adequate support.



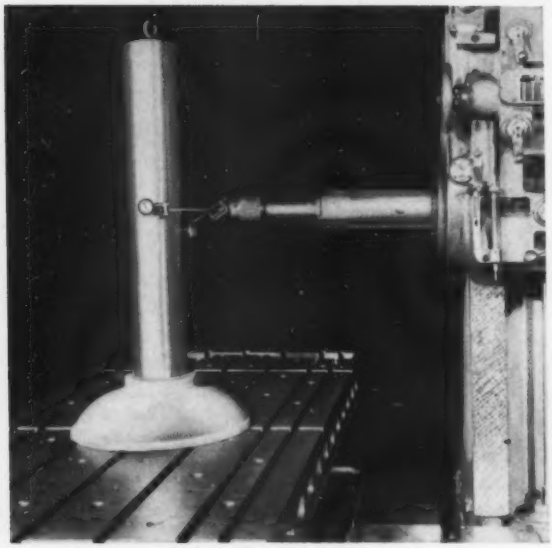
Relief valve that requires no piping made by Double A Products Co.

## Pilot-Operated Relief Valve

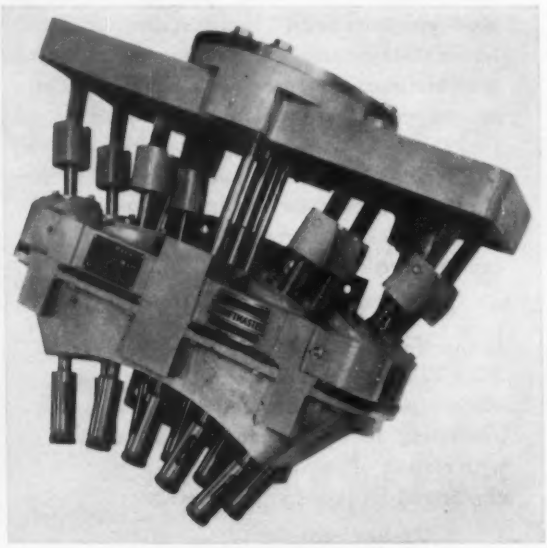
No piping is required to install a hydraulic, pilot-operated pressure-relief valve manufactured by Double A Products Co. (a subsidiary of Brown & Sharpe Mfg. Co.), Manchester, Mich. This is one of a series of newly designed CircuitStak pipeless hydraulic valves.

The relief valve, Model BTP-175, is installed in the circuit by being sandwiched between a 3/4-inch, gasket-mounted, four-way valve (such as Double A Model QF6-175) and the sub-plate, or manifold. The stacking of circuit components in this manner eliminates all interconnecting pipes, and reduces the size of the valve panel required. Savings of up to 50 per cent are claimed over the cost of mounting and piping relief valves in the conventional manner.

**Circle Item 602 on postcard, page 215**



"Tru-Plumb" machine-aligning tool



Thriftmaster special drill head

## Wire-Annealing Equipment

"Thermatool" electronic equipment, utilizing the principle of high-frequency resistance heating to anneal almost any metal wire that can be water-quenched, has been developed and is being manufactured by New Rochelle Tool Corporation, New Rochelle, N. Y.

In the production of wire from billets, which requires the drawing of metal strands through various dies at a very high speed, the wire becomes hardened and embrittled to the point where further drawing will cause it to break. Therefore, the wire must be annealed one or more times during drawing.

The "Thermatool" annealer, by passing a 450,000-cycle current directly through the wire, heats it by high-frequency resistance losses without arcing or marking the surface. The wire being annealed passes into a feed-roll system which guides it vertically through a 7-foot, glass-lined tube of the "Thermatool" annealer illustrated. High-frequency current enters the wire at the top and leaves at the bottom by means of contacts. The lower 6 inches of the unit is a quenching device, which removes the heat from the wire before it hits the lower contact. The tube around the wire acts as a coaxial return conductor.

The wire carries several hundred amperes of current between the two contacts and in traveling rises in temperature to some preset value, such as 1250 degrees F., and then enters the quench. The quench extracts the heat from the wire and allows it to hit the second contact in a nearly cold condition. Should it hit the second contact in a hot condition, the wire would be marked.

The equipment includes a generator, water condenser, input-voltage regulator, a mechanical wire-guiding and feeding device, and an automatic length compensator for changes in length of wire during the annealing operation. The device is a complete package unit which can be installed in a wire-drawing line as an interim annealing unit, or as an annealing device for transferring wire from one reel to another in the annealing process. At the present time, the equipment is limited to wire diameters between 0.128 and 0.030 inch.

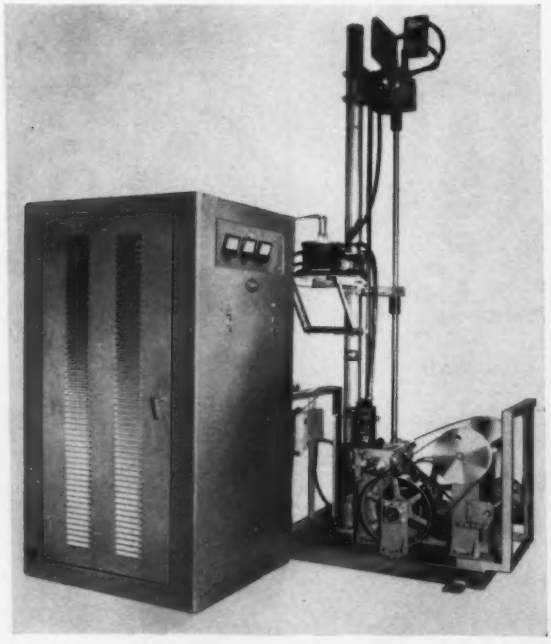
Two sizes of power supply are available—25 and 60 kw. A 25-kw unit will anneal 300 pounds of brass or bronze wire per hour (700 feet per minute for wire 0.051 inch in diameter, or 100 feet per minute for wire 0.128 inch in diameter). A 60-kw unit will anneal 600 pounds of brass or bronze wire per hour.

**Circle Item 604 on postcard, page 215**

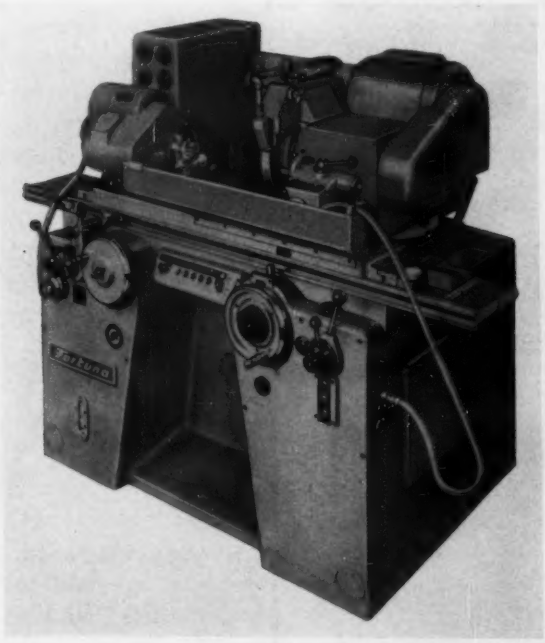
## Fortuna Cylindrical Grinders

Sixteen types of Fortuna AFB series cylindrical grinding machines, ranging from a plain, manually fed grinder to fully automatic-cycle-control models, are now available through the Cosa Corporation, New York City. The Fortuna grinders are used for traverse and plunge-cut grinding and are easily adapted to internal grinding of single or mass-produced work-pieces. They feature a hydraulic table traverse with infinite speed variation between 2 inches and 26 feet per minute, two-speed table traverse handwheel, easily adjusted table dwell, and smooth table reversal that is accurate within 0.0004 inch. The work-piece table can be swiveled for taper grinding, and has a dial gage and

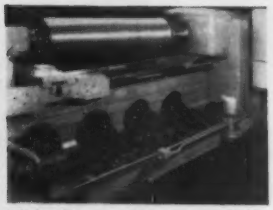
*(Continued on page 232)*



"Thermatool" electronic wire-annealing equipment



Fortuna cylindrical grinder introduced by Cosa Corporation



Chip flow to the rear of the machine for easy removal.



36 spindle speeds in a range of 8 to 1000 R. P. M.



Four-way variable speed power rapid traverse.



Power tailstock positioning on flame hardened bed ways.



No chip pan obstruction at front of machine.



Tailstock design permits setting compound rest parallel to work axis.

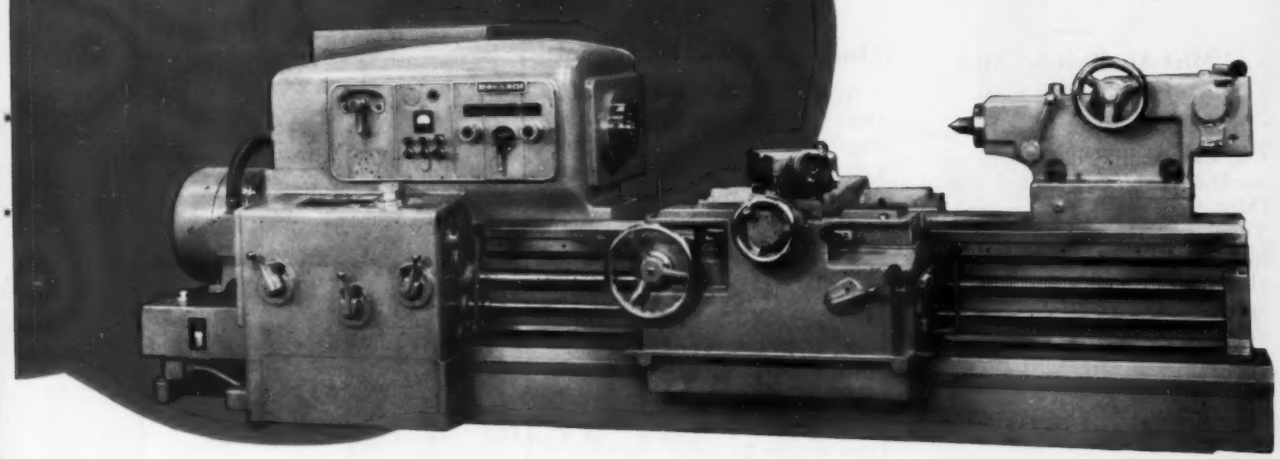
**Check the Model 3220,** feature for feature, against any other heavy duty lathe of similar swing capacity. Here are the major plus values. Add them up and you get only one answer — greater productivity hour after hour — day after day — year after year. This is worth investigation!

| | Monarch Model 3220 | Other 25" Or Model 3220 Machines |
|---|---|---|
| Number of spindle speeds | 36 | |
| Speed range | 8 to 1000 R. P. M. | ? |
| Surface cutting speed automatically calculated | Yes | |
| Hole in headstock spindle | 3 5/8" | |
| Spindle jog | Automatic | ? |
| Headstock lubrication | Mist | |
| Attention-free hydraulic clutch and brake | Yes | |
| Swing over bed and carriage wings | 32" | |
| Bed width | 26½" | ? |
| Totally enclosed end gearing | Yes | |
| Four flame hardened and precision ground bed ways | Yes | |
| Chip flow to rear for easy removal | Yes | |
| Chip pan obstruction at front | No | ? |
| Automatic traveling rod supports | Yes | |
| Variable speed power rapid traverse to carriage and cross slide | Yes | |
| Automatic disengagement of apron handwheel and cross feed dial during traverse | Yes | ? |
| Apron handwheel and cross feed dial pick-up at same spot after traverse | Yes | |
| Feed range | .003" to.1683" per rev. | ? |
| Backlash eliminator when using taper attachment | Yes | |
| Tailstock spindle diameter | 6½" | |
| Power tailstock positioning | Yes | ? |
| Anti-friction tailstock spindle suitable for drilling, tapping and reaming | Yes | |
| Tailstock design permits setting compound rest parallel to bed ways | Yes | |
| Stock removal, cu. in. per minute, up to | 92 | ? |
| Net weight of base length (48") machine | 19,660 lbs. | |

# YOU GET MORE...
# YOU PRODUCE MORE

## with the Monarch Series 80
## Heavy Duty Dyna-Shift Lathe—Model 3220

(ALSO DESIGNS DESIGNATED AS 25" LATHES)



You'll suffer — competitively — if you tool up today with yesterday's lathes for the boom of the Soaring Sixties. The Monarch Series 80 is truly the lathe of tomorrow, as are the other new Monarch high production and special purpose lathes. Send for our illustrated Booklet #1603 for full Series 80 information — or state your other interests.

**Monarch** TURNING MACHINES

THE MONARCH MACHINE TOOL COMPANY, SIDNEY, OHIO

**IF IT CAN BE TURNED, THERE'S A MONARCH TO DO IT BETTER AND FASTER**



For more data, circle this page number on inquiry card

stop for angular settings. Built-in controls pre-select traverse speed.

These automatic cylindrical grinders control rough- and finish-grinding through the "Finitor," an automatic sizing device which controls the "infeed" of the work-table by continuously measuring the work-piece, thus eliminating the effects of wheel wear. The "Finitor" permits automatic control to a definite pre-selected stop in both rough and finish operations. Spark-out time can be set automatically.

Special features of the Fortuna grinders permit them to be used for grinding multiple-diameter work-pieces, fillets, faces, and tapers in one operation. Automatic loading devices, stepless variable-speed drives, and automatic cycling equipment are also available.

**Circle Item 605 on postcard, page 215**

## "Mist-Air-Rester" Mist Collector

The Standard Electrical Tool Co., Cincinnati, Ohio, has recently made available a complete line of "Mist-Air-Rester" mist collectors. These units are offered as accessory equipment for this company's electrolytic spindles and for other applications of electrolytic and wet machining. They are applicable to tool grinders, centerless grinders, wet grinders, and wherever mist or fog is detrimental. This equipment is designed for durability and simplicity of operation, installation, and maintenance.



Mist-collector equipment brought out by the Standard Electrical Tool Co.

Accessory items such as special hoods, piping, etc., are available for connecting the Mist-Air-Rester to various machines as well as electrolytic spindles. The mist and fog are collected in the immediate area of the work and disposed of in the filter chamber, thus preventing hazards to plant personnel and machinery.

**Circle Item 606 on postcard, page 215**



Size 834 Ingersoll-Rand Impactool

## Ingersoll-Rand Impactool

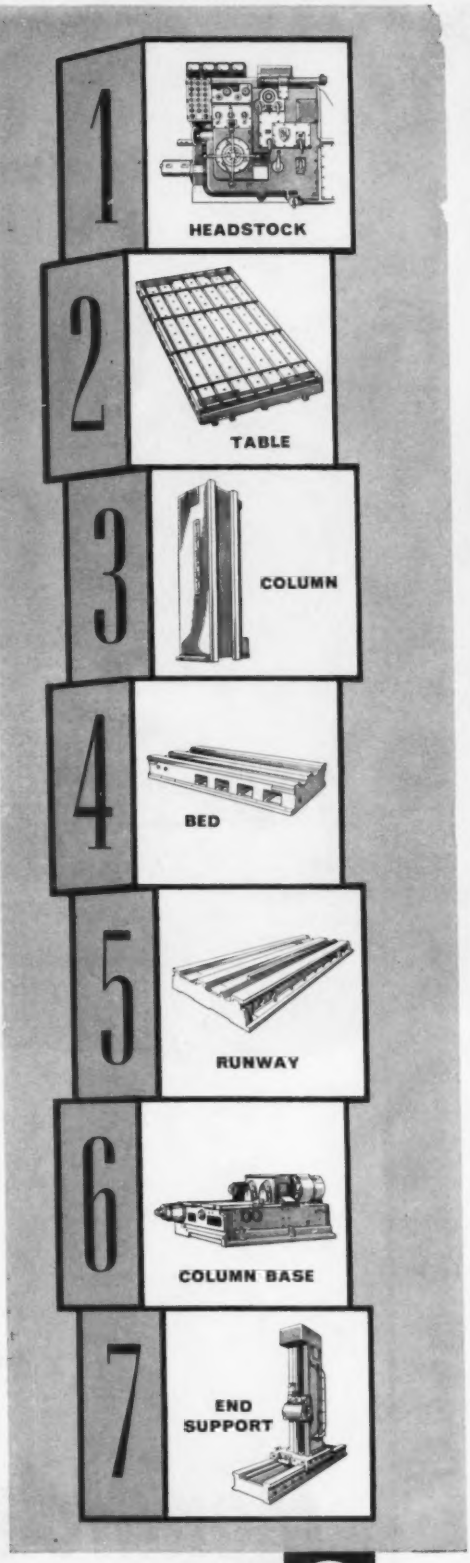
A Size 834 air-powered Impactool has been developed by the Ingersoll-Rand Co., New York City, to give 25 per cent more power and to run down nuts and bolts five times faster than its preceding model, known as the Size 534 Impactool. The extra power and speed of the new tool are said to result from the improved direct drive between motor and hammer.

This tool is especially adapted for production and maintenance work requiring nut-running operations within its rated capacity of 1 1/4-inch bolt size. New design and construction also give this Impactool a more favorable power-to-weight ratio than preceding models and enable it to operate at maximum efficiency with 25 per cent less air consumption. The compact design plus strong, light-weight alloy castings for handle, motor housing, and hammer case make the tool 7 pounds lighter, even though the motor is larger than that of the previous model.

The tool will spin down nuts with a free speed of 3500 rpm, and delivers 850 powerful impacts per minute. It weighs 19 7/8 pounds, is 13 1/16 inches long, and has a side-to-center distance of 2 1/16 inches. It is rated to run bolts up to the 1 1/4-inch thread size.

**Circle Item 607 on postcard, page 215**

*(This section continued on page 234)*




symbol for machining cost reduction

GIDDINGS & LEWIS

GLF-112

GIDDINGS & LEWIS
T. M.

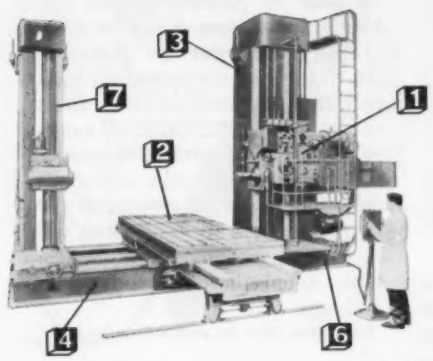
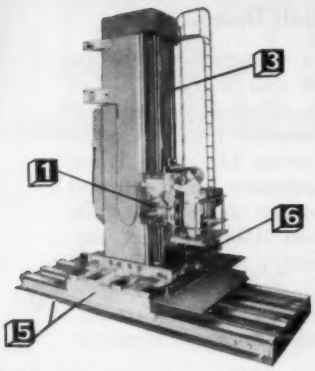
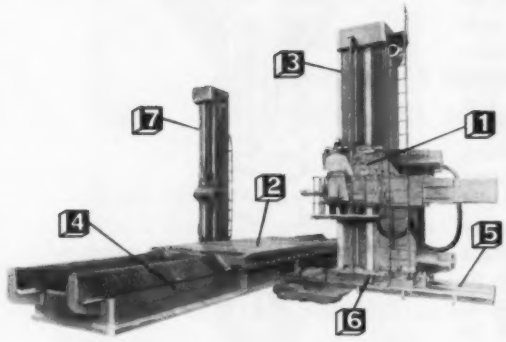


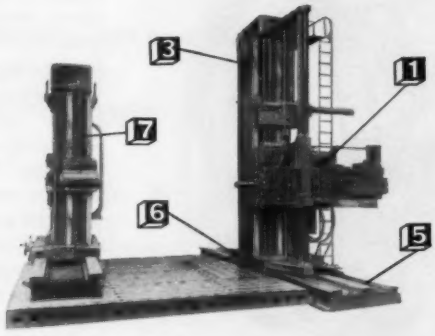

TABLE TYPE




FLOOR TYPE WITH CROSS SLIDING COLUMN




PLANER TYPE




FLOOR TYPE

# G&L building-block principle cuts cost... gives you more for your money

When you order a Giddings & Lewis horizontal, you get a machine custom-built to your requirements at the price of a standard machine because it will be built up of interchangeable building-block units.

This building-block concept has long been used by G&L to reduce manufacturing costs and to make possible extra features and extra quality at competitive prices.

There is an almost unlimited variety of arrangements possible with standard components. This, together with the most complete line of attachments and accessories available, enables you to specify the machine that best suits your requirements without paying the price penalty normally associated with custom-built equipment.

Every Giddings & Lewis horizontal is an extremely rugged and precise instrument for removing metal. Heavy-duty construction with generous safety factors enables G&L machines to take on the really tough jobs, while at the same time delivering toolroom capabilities and accuracy — all at the price of a standard production machine.

For horizontals "designed" to your shop requirements — for machines with the versatility, accuracy, and ease of operation that spell greater production and profits—consult your local Giddings & Lewis distributor or write today.

• • •

*World's most complete and versatile line of horizontal boring, drilling, and milling machines.*

**GIDDINGS & LEWIS MACHINE TOOL COMPANY · Fond du Lac, Wisconsin**

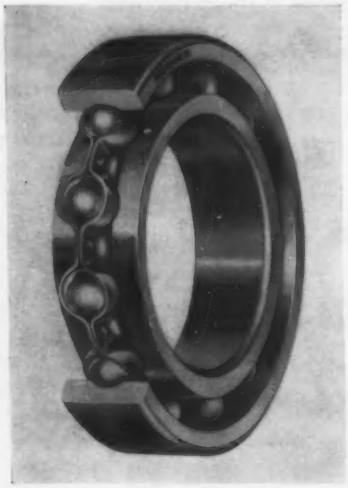
Giddings & Lewis manufactures: vertical and horizontal boring machines, vertical turret lathes, planers, planer mills, contour milling machines, die sinking machines, drilling machines, numerical and tracer control systems, boring tools and related items, and machine tool accessories.



For more data, circle this page number on inquiry card

## Hoover Extra-Light Ball Bearings

One of a line of 3L00 extra-light series ball bearings, featuring a wide selection of sizes and types announced by the Hoover Ball & Bearing Co., Ann Arbor, Mich. Dimensions for width and outer diameter are substantially smaller than standard light, medium, or heavy series bearings of comparable shaft sizes. As a result, these extra-light bearings are recommended for applications requiring maximum shaft diameters and minimum housing areas. The variety of styles offered includes open-, single-, or double-shield, single- or double-contact seal, and combination contact seal and shield. All these variations are available either with, or without, snap-ring. Of particular interest are lubricated-for-life, extra-light bearings with contact seals of Teflon. Available in shaft sizes from 17 to 65 millimeters.



Circle Item 608 on postcard, page 215

## Milling Cutter with Inserted Blades

Milling cutter, designed to employ throw-away type indexable cemented carbide insert blades, brought out by the Super Tool Co., a division of Van Norman Industries, Detroit, Mich. This cutter is reported to reduce milling time as much as 50 per cent, and to completely eliminate the necessity of regrinding the blades. The cutter is designed to insure precision holding of the insert blades, yet allow indexing to a new cutting edge in about thirty seconds.

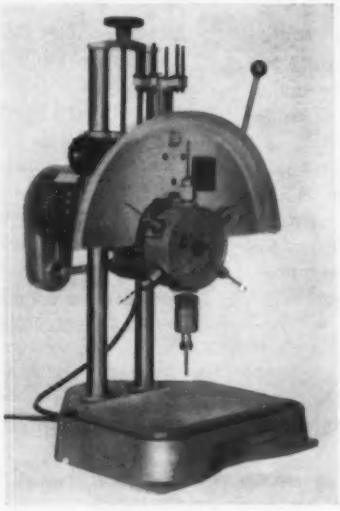


Each inserted blade sits in a precision-ground pocket of the cutter body. This provides greater rigidity, and when indexing, it assures accurate resetting of each blade. Also it prevents the blades from being pulled out of the cutter body when taking heavy cuts. The blades are indexed by simply loosening a holding screw, turning the insert 90 degrees, and tightening the screw. Depending on design, the carbide inserts are manufactured to provide four to eight cutting surfaces and are made in grades for milling cast iron or steel. The cutter body is made in 4- to 12-inch diameter sizes.

Circle Item 609 on postcard, page 215

## Six-Spindle Bench Model Turret Drill

Model "O" six-spindle turret drill announced by Burgmaster Corporation, Gardena, Calif. Revolving turret of machine permits one operator to perform several machining operations at one location.

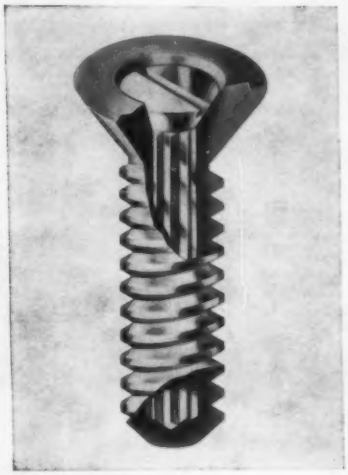


The turret can be power-indexed to bring any one of six tools into the machining position. Each of the six spindles has a full range of adjustable, pre-selective speeds, as well as adjustable, automatically indexed stops to control the depth to which the tool enters the hole. The machine drills, reams, taps, counterbores, countersinks, and laps.

Circle Item 610 on postcard, page 215

## Composite Plastic Screw with Metal Core

Plastic screw with a metal core, called the "Insul-Screw," announced by Austin Screw Products Co., Chicago, Ill. Manufactured under United States and foreign patents, it has the insulating properties of plastic combined with the strength of metal. It is shock resistant, vibration dampening, and chemically inert. The Insul-Screw consists of a serrated metal core with a threaded plastic body. The metal core carries the torque applied by the driving means and eliminates the danger of breaking or distorting the head. Standard materials for Insul-Screw are nylon and steel, but other plastics and metals are available for special applications. This self-insulating screw eliminates vibration and corrosion problems, and has the additional advantage of being self-locking.



Circle Item 611 on postcard, page 215

*(This section continued on page 237)*



# TOOL NEWS carbide

# What do you get when you buy a cutting tool?

- DELIVERY?
- ENGINEERED DESIGN?
- QUALITY? • ACCURACY?
- TROUBLE-FREE OPERATION?
- LONG LIFE?
- PERFORMANCE?

You may expect many things, but what you get is what counts. When you buy "Wesson" you actually get all of them—but, more important, you get real SERVICE.

That's not just a claim. Here is a typical example to show how Wesson SERVICE works full time—before, during and after the order.

## A TYPICAL PROBLEM

For years, the high tool cost of boring crank ends of automotive connecting rods was a problem. All cutters tried were hard to grind and even harder to set up. They had to be frequently dismounted to make needed adjustments.

## THE WESSON SOLUTION

Full time Wesson Service Engineer Burt Dupuis was in a large engine plant looking for problem spots. The crankpin machines caught his eye. Burt got an idea. He sketched it out and sent it to Wesson engineering for detailing and to prove it out on paper.

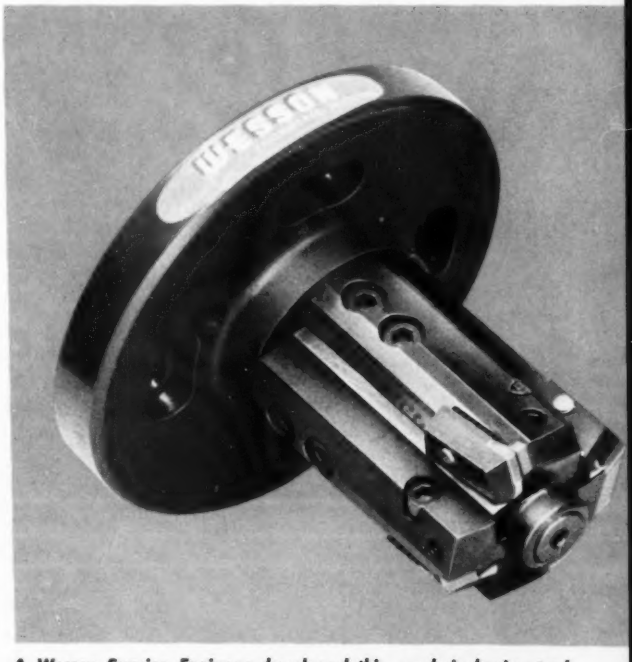
The blueprint decided the company to try one cutter. Burt delivered it, mounted it, and watched it cut. He was on the right track. All the cutter needed was a slight refinement. The company still used the original cutters too for a while but they have all been replaced now.

The result? Almost too good. Tool costs are 1/5 of what they were before. For over 2,000,000 holes bored per year, tool costs are only $4,488 compared with $21,058 formerly—**an annual saving in excess of $16,500.**

| TOOL COST COMPARISON | | |
|---|---|---|
| | Former Method | WESSON Way |
| Consumption tooling (per cutter), $ | $20.88 | $3.28 |
| Tool cost per part, $ | .0023 | .0006 |
| Grinding cost per part, $ | .0060 | none |
| Set-up cost per part, $ | .0022 | .0017 |
| Total Tool Cost per part, $ | .0105 | .0023 |

## THE CUTTER THAT DID IT

Burt's tool uses four throw-away insert holders. Each is replaceable and independently adjustable axially and radially. Two opposed inserts — *(Continued on next page)*



*A Wesson Service Engineer developed this crankpin boring tool while looking for trouble spots in a customer's plant. In one pass, it roughs and finishes for a saving of over $1500 per month.*

### What Do You Get?

*(Continued from previous page)* rough and two finish so the whole job is done in one pass.

Only the finishers need adjusting on the machine and this is done simply and quickly. Whenever the air gage shows that tool wear has dropped the bores near the low limit, the operator simply turns a cone screw on the tool with an Allen wrench. This resets both finishing inserts to bring the bores back to the high limit. Only when the finishing inserts need indexing (to another of the 8 cutting edges) is a bench setup required. Roughing inserts are indexed on the machine.

Not only do the inserts produce more parts per cutting edge but huge savings result from reduced down time for adjustment and elimination of grinding.

### BUT THAT'S NOT THE END

Burt Dupuis still watches this job from time to time to see how it's going. He's already suggested substituting a quick change holder for the present design. This should reduce down time costs even more.

### FOR YOU, TOO

That's the way Wesson SERVICE works. And back of it are competent design, service and research facilities to continually improve Wessonmetal and work on advanced tool ideas. Our full time experienced service and sales engineers assist on carbide application test programs. Every Wesson employee provides some service to our customers and prospects. Try it for yourself.

tools Wesson carbide Wessonmetal
WESSON COMPANY, DEPT. AD
1220 Woodward Heights Blvd., Detroit 20, Mich.
IN CANADA:
WESSON CUTTING TOOLS, LTD.
93 Judge Road, Toronto 18, Ontario

# Wesson Tracer Turning Tools Made Standard Line

**FOUR DIFFERENT HOLDERS ALL USE SAME 4 SPARE PARTS AND STANDARD 55° DIAMOND-SHAPED THROW-AWAY INSERTS**




STYLE DAL-C

***Style DAL-C tracer turning tool cuts from left to right. Its mirror image, Style DAR-C, cuts from right to left. Style DTRL-C is symmetrical and cuts either way. For Fischer lathes only, Style MX-8-T5C cuts from right to left.***

Introduced as specials three years ago, these Wesson Multicut holders have been designated as standards in recognition of their acceptance.

They can be used on most machines for tracing, out-facing, plunge-turning, recessing and undercutting.

Whatever your tracing needs, these holders are available from stock, and the carbide inserts, in various grades, have also been made standard. These holders have all the advantages of throw-away insert tooling plus the big advantage of standardized, interchangeable parts for all four styles.

*Write for Bulletin #459.*

# Conventional Carbide Tools Best Bet For Most Jobs

## 2. *"Throw-away" milling cutters*

The Wesson "wedge-behind" series of milling cutters with throw-away carbide inserts are now classed as conventional tooling and they have demonstrated production ability on light, medium and heavy cuts on cast iron or steel. These cutters are designed for lowest cost per edge on most rough and semi-finish milling operations.

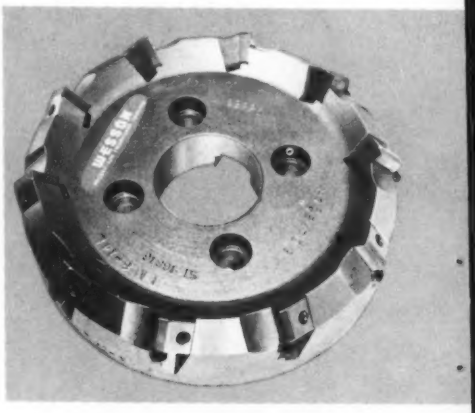
Indexable throw-away solid carbide square inserts eliminate the need for grinding, provide 8 cutting edges and permit at-the-machine cutter maintenance. A precision pin and the V-block principle of insert seating-location achieve uniform blade location easily. Total runout of blade slot is within ±0.0003 inch.

The wedge behind the insert provides full support and protects the cutter body in case of smash-ups. Inserts can be changed quickly because the wedge rides up and down on the actuating screw as it is turned.

These cutter series are immediately adaptable to present machines and adaptors without heavy expenditures for conversion.

Next time you have a milling operation to set up, consider these cutters. To be ready with data:

*Write for Bulletin #M-358.*




LITHO IN USA




### Wesson "Multicut" Insert-Holder for Tracer Turning

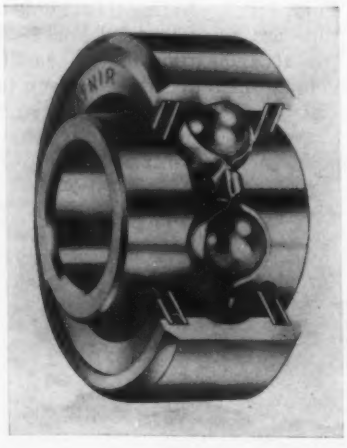
One of a family of standard "Multicut" insert-holders for tracer turning is designed by the Wesson Co., Detroit, Mich. All component parts of this line, except the holder shanks, are now standardized and interchangeable. One anvil locator, one clamp, one locking screw, one taper-head screw, and one 55-degree diamond-shaped insert will fit all four holders so that spare-parts inventory can be considerably reduced. These tools can also be used for recessing, outfacing, undercutting, and plunge-turning. The anvil locator and clamping flats on both sides of the insert are precision ground so that the insert is held securely in the anvil locator, preventing cutting loads from causing chatter or displacement of the insert.

Circle Item 612 on postcard, page 215

### Fafnir Ball Bearing for Aircraft Control

High-temperature, low-torque, sealed ball bearing for high-speed sensitive aircraft control applications announced by the Fafnir Bearing Co., New Britain, Conn. Fabricated entirely of stainless steel, heat-stabilized, and lubricated with heat-resistant oil. Available with Teflon fabric seals capable of withstanding temperatures in the 550-degree range. This AW-AK series bearing is equipped with stainless-steel ball separators that insure extremely low torque. Bearing widths to close tolerances permit easy mounting in standard brackets.

Circle Item 613 on postcard, page 215





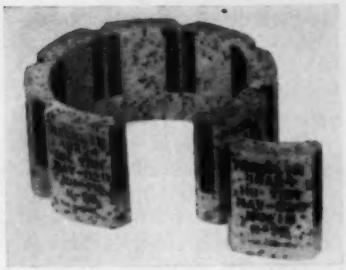
### Buckeye Air-Powered Router

Partial or complete cuts through metals, plastics, woods, or even honeycomb materials can be made with an air-powered router developed by Buckeye Tools Corporation, Dayton, Ohio. Vibration-proof, positive-locking depth adjustment; oversize front end bearings; and full-length, full-grip collet are tool features that insure accuracy in cutting, even when following the most intricate contours. The open construction of the router base provides a clear view of the cutting operation. Air exhaust is directed downward across the router bit to expedite chip removal. The complete tool weighs only 3 pounds, measures 7 1/8 inches in length, and has a rated collet capacity of 1/4 inch.

Circle Item 614 on postcard, page 215

### MM Process Abrasive Wheels

Segments of new material used in abrasive wheels and segmental wheels developed by the Macklin Co., Jackson, Mich., to increase

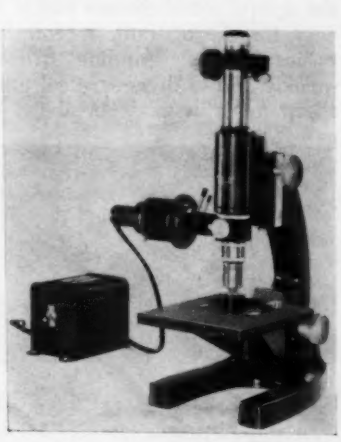


production in the grinding of carbides, cast iron, and hard-to-grind steels. These abrasive wheels have undergone extensive field and laboratory testing over a three-year period and are said to show a marked improvement on various grinding applications as compared to wheels previously made by conventional methods. The MM process involves the uniform, loose dispersion of fine abrasive pellets throughout the matrix of the wheel. The pellets function as a cooling element, and release a flow of loose abrasive between wheel and work. It is this secondary action which increases the rate of stock removal and improves surface finish. The pellet construction also permits the use of a harder, longer-lasting wheel matrix.

Circle Item 615 on postcard, page 215

### B&L Electroplater's Microscope

Electroplater's microscope designed to provide rapid, accurate measurements of plating thickness with the same high-quality results as instruments which are considerably more expensive, announced by Bausch & Lomb Optical Co., Rochester, N. Y. This



instrument has been designed for user comfort. The fine-adjustment knob is located close to the table top to allow the arm to rest in a natural position when making the slightest change in focus. The objective is centered in a single nosepiece, and the instrument is easily portable for on-the-spot examination and analysis. The Filar micrometer eyepiece includes a movable hair actuated by a micrometer screw with a drum graduated in 100 divisions. Each division represents 0.00001 inch on the specimen when the 40X objective (supplied with the instrument) is used. The eyepiece also includes a fixed scale to facilitate counting the revolutions of the drum—each least division on the scale representing one-half revolution of the drum. A calibration record is included with each instrument.

**Circle Item 616 on postcard, page 215**

## "Spin-Kontrol" Wheel Dresser

A new type wheel dresser, called "Spin-Kontrol," manufactured by the Jarvis Corporation, Middletown, Conn. This dresser features a free-spinning wheel which is said to offer exceptional dressing ease, versatility, and control. It is particularly advantageous for use on diamond wheels because by its spin-controlled crushing effect it removes bonding material and exposes the diamonds without tearing them from the wheel. This is said to result in substantial savings in diamond-wheel replacement costs. Revolving instantly on contact, the Spin-Kontrol dresser makes it easy for the operator to form a radius on a grinding wheel quickly and to dress a wheel to a sharp angle without breaking it down along the edge. It is furnished with three wheels, one each for dressing diamond, coarse-grit, and fine-grit wheels.



**Circle Item 617 on postcard, page 215**

## Sundstrand Orbital Electric Sander

Orbital electric sander Model EO 900 announced by Sundstrand Machine Tool, Division of Sundstrand Corporation, Rockford, Ill. This high-output unit is designed for continuous one- or two-hand



operation on single-phase, 115-volt alternating current. It is adapted for use on a wide range of industrial applications. A single-phase motor of unique design insures constant operating speed without requiring belt or gears. It provides high starting torque, and is overload-proof. Its simple and extremely sturdy design requires no centrifugal switch. There are no commutator or brushes to require servicing. Special sanding paper sizes are not required since the sander uses one-half a standard sheet. Eight interchangeable pads are available for use on a variety of finishing operations such as sanding grooves, soft-shaped surfaces, polishing, and conventional sanding of wood, as well as metal and other materials.

**Circle Item 618 on postcard, page 215**

## Motorized Rotary Grinding Table and Index Fixture

Model 710-V combination motorized rotary grinding table and index fixture brought out by the M & M Tool & Mfg. Co., Dayton, Ohio. This equipment is especially designed to provide a power rotary table for surface grinding and also for use as an index-table. It can be hand-operated to give a combination index of 2, 3, 4, 6, 8,

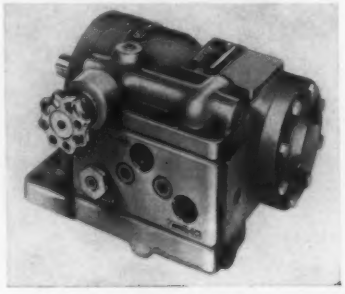


12, and 24 spacings for jig grinding or drilling of equally spaced holes. The table can be used for inspection, as well as production work. Parts can be quickly drilled without fixturing or drill jigs. Index accuracy on a 10-inch circle is held to 0.0003 inch on twenty-four sections. This combination model is especially adapted for use in die shops, toolrooms, model shops, and for plastic plants. The table is powered by electric motor with variable-speed control.

**Circle Item 619 on postcard, page 215**

## Vickers Two-Volume Pump

Two-volume pump, requiring only a single pressure setting for both unloading and maximum pressure, announced by Vickers Incorporated, Detroit, Mich., a division of Sperry Rand Corporation. It is designed to prevent excessive heat generation and wasted horsepower by automatically maintaining system pressure with a small-volume pump while a fixed differential between the relief-valve setting and the unloading valve allows return of large-volume pump capacity to the reservoir at negligible pressure. Pumps incorporating this new feature are recommended for 1000 psi at 1200 rpm in the small-volume operation cycle and up to 750 psi at 1200 rpm in the larg-





Klingelnberg Hob Grinders are available in two models to sharpen 12" diameter hobs 12" and 16" long.

# These are the features that sold Illinois Gear* on the KLINGELNBERG HOB GRINDER

## ...and keep them sold

The Klingelnberg Grinder you see here is sharpening a 12" diameter by 15" long hob for cutting giant precision gears at Illinois Gear and Machine Co., Chicago. Gears up to 134" diameter with a 58" face.

Why on a Klingelnberg? Because:

**1** Spacing of gashes is held closer on the Klingelnberg than on any other machine.

**2** Large precision indexing plate, mounted directly on work arbor, guarantees accurate spacing.

**3** Spiral lead is *mathematically* accurate through change gear train—not hampered by errors inherent in sine-bar settings.

**4** Fully automatic cycle—grinding and spark out—keeps hob sharpening time down to a minimum.

**5** Automatic wheel dresser is hydraulically operated, controlled from operator's stand.

Yes, there are very good reasons why more and more precision hob grinding is being done on fully automatic Klingelnberg machines. You've just read five.

*Want to get the whole story? Just write us.*

*...and DeLaval; General Electric; Chevrolet; Allison Div. of GMC; Hyster; Chicago Gear; Industrial Gear; Philadelphia Gear; Cleveland Worm & Gear; Eberhard-Denver; Henry J. Thompson—and so many others.

KO CO., INC. PRECISION MACHINERY

**KURT ORBAN**

**COMPANY, INC.**

42 Exchange Place, Jersey City 2, New Jersey



For more data, circle this page number on inquiry card

er-volume operation cycle. Two pump groups are provided. One has eighteen combinations of the small-pump cartridges with capacities, at operating pressure, of 4.0 to 21.4 gallons per minute for large-volume operation. The other has thirty combinations of the small- and large-pump cartridges with capacities, at operating pressures, of 14.7 to 45.2 gallons per minute for large-volume operation.

Circle Item 620 on postcard, page 215



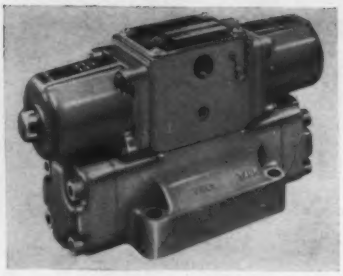
## Williams Pipe Tongs Made with Heat-Treated Chain

Chain pipe tongs equipped with heat-treated flat-link chains made by J. H. Williams & Co., Buffalo, N. Y. A 40 per cent increase in strength extends chain life and improves tong performance. Flat links are made from selected steel. Rivets and swing links are of alloy steel. All chains are heat-treated after assembly and proof-tested to two-thirds of their breaking strain.

Circle Item 621 on postcard, page 215

## H-P-M Four-Way Valve

H-P-M 3/4-inch, four-way valve of 3000-psi, 20-gallon-per-minute capacity for pilot-operated, solenoid-controlled applications announced by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio. This valve features oil-immersed solenoids and is completely interchangeable with standard equipment. One year of rigorous testing on high-speed, fast-cycling production machines indicates



that the valve has a life expectancy of twenty to thirty times that of conventional valves previously employed. The oil-immersed solenoid is housed in a tightly sealed die-cast housing, eliminating the damaging effect of corrosive dust and dirt in the electrical component. The solenoids operate quietly at comparatively low temperatures and with little shock. They may be removed with the valve body for inspection without breaking primary electrical connections. The solenoid assembly is connected by a bayonet type receptacle similar to a common 110-volt connection. The sub-plate-mounted valve is provided with optional spools for all standard four-way valve applications.

Circle Item 622 on postcard, page 215

## Signaling Controller

Signaling controller that provides highly accurate, automatic control of industrial operations, suitable for two-position control action, developed by Thermo Electric Co., Inc., Saddle Brook, N. J. This controller can be used with any transducer generating a direct-current signal, such as thermocouples, tachometer generators, load cells, etc. Corrective action occurs almost simultaneously with detection of any input-signal deviation.




It is sensitive enough to react to a change of but 1 microvolt. Calibration accuracy is guaranteed to be within plus or minus 0.25 per cent of full scale span or 5 microvolts. Ranges are available from 1 to 100 microvolts. The controller also includes a high-gain control amplifier that combines stability with extreme sensitivity and noise suppression. Red and green signal lights on the instrument door indicate process conditions. A built-in safety control action causes the control relay to shut off process heat immediately when failure of any system component occurs.

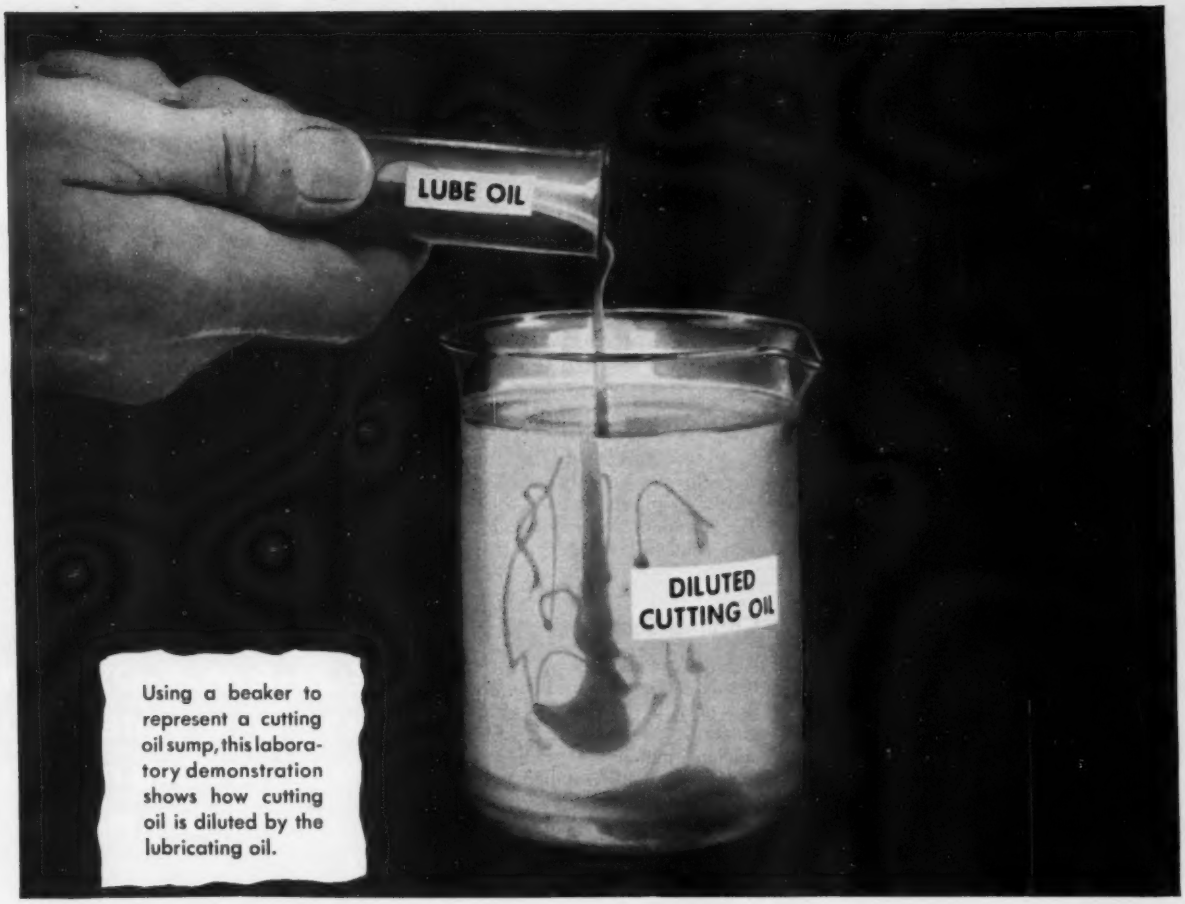
Circle Item 623 on postcard, page 215




## Oiltight Pressure Switch

Oiltight pressure switch for heavy-duty industrial applications on machine tool hydraulic systems operating at pressures up to 5000 psi announced by the Allen-Bradley Co., Milwaukee, Wis. This Bulletin 836, Type T, is a compact unit with a die-cast aluminum enclosure completely sealed to exclude oil and water. The Type T will also meet NEMA 12 requirements. A calibrated scale and indicator show the operating pressure, and a visible trip indicator shows when the contacts operate. The range-adjustment control, mounted on the top of the enclosure, changes both operating and reset pressure. The differential adjustment controls the reset pressure only, and is accessible from the front when the cover is removed.

Circle Item 624 on postcard, page 215




Using a beaker to represent a cutting oil sump, this laboratory demonstration shows how cutting oil is diluted by the lubricating oil.

# Diluted cutting oil can cut output 33%

No matter how careful your lubricating techniques, you still can't stop lube oil from leaking into the cutting oil sump on 70% of automatic screw machines. As cutting oil is diluted, it loses strength—ingredients that make it efficient become less and less effective. The natural consequence is shortened tool life, more downtime and a higher percentage of rejects.

**Texaco Cleartex can end this problem forever.** All you have to do is use Cleartex for both cutting *and* lubrication . . . and watch your production rise. The exceptional chemical stability and load-carrying ability of the Cleartex series make them equally suitable for use as cutting oils, lubricants and hydraulic fluids. (70% of all automatic screw machines can benefit from the "Cleartex Cure!")

**TAKE THE CLEARTEX CURE SOON!**

Write today for your copy of Texaco's new booklet—"Cleartex in Automatic Screw Machines." This new illustrated guide will fill you in on the details, show you where you may be losing profits and how to avoid it . . . Or contact your local Texaco Lubrication Engineer soon for an authoritative survey of your automatics. Just call the nearest of more than 2,300 Texaco Distributing Plants, or write to Texaco Inc., 135 East 42nd Street, New York 17, New York. Dept. MA-13.




Tune In: Texaco Huntley-Brinkley Report, Mon.-Fri.-NBC-TV

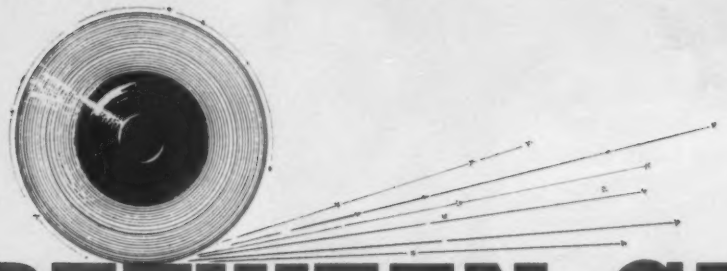



## LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)



For more data, circle this page number on inquiry card



By E. S. Salichs

# BETWEEN GRINDS

## An A for Adamas

Tungsten-carbide tips are made by Adamas Carbide Corporation for canes used by the blind. The carbide inset provides a desired uniform bounce of approximately 2 inches.

## Great, G and G

*Grits and Grinds*, a technical magazine published by the Norton Co., celebrated its Fiftieth Anniversary in July. It is one of the ten oldest company publications in the country. Early issues were directed to the Norton sales force, but later issues were dedicated to better grinding. *Grits and Grinds* now has a monthly mailing list of 90,000 in the United States, and 13,000 overseas; there are six foreign language editions, besides an Australian edition. Taking a backward glance, Editor E. T. Larson commented, "It may interest our readers to know that fifty years ago the crankshafts for practically all American-made automobiles were shipped to Norton Co. for grinding and balancing. That was before the auto manufacturers had accepted the idea that grinding was here to stay and before they were ready to purchase their own grinding machines and pay grinder hands five cents more an hour than lathe hands."

## Corking Service

The Armstrong Cork Co. handled highly technical questions about its products at the last Design Engineering Show in Philadelphia in an efficient manner. It had a special telephone booth installed with a direct line to the company's Research and Development Center in Lancaster. Then went a step further and placed in the booth a panel of photographs of the people at the Center; as you asked a question, the picture of the person to whom you were talking lighted up.

## Real Cool Connecticut

"Divest yourself of your coat and tie if you wish" was the welcome to summer visitors at the Baird Machine Co., Stratford, Conn., by way of a sign tacked on the wall in the reception room.

## Slang with a Bang

An article in January *Steelways*, written by Walter Wager, begins: "If you wake up some morning in a place where the 'strippers' are machines, a 'drink' is molten metal and a 'bouquet of roses' can crush you, you could be in either a surrealist night club or emerging from a very bad dream. The odds are that you would be in a steel mill." The bouquet of roses, incidentally, refers to glowing ingots en route from the soaking pit to the blooming mill. The foundation for these and many other terms was laid by the rugged men, some of them speaking only basic English, who earlier developed the steel industry. Here are some expressions in use today: "hairpins," hooks for handling coils; "skull," frozen metal and slag found in the bottom of ladles used for molten metal; "shrouds," tarpaulins to cover steel; "donuts," rotary billet furnaces; and "elephant ears," crane mold tongs.



THE BIG BLOB—In reality, an inflatable radome, a sort of ear muff, meant to keep ice, sand, snow, dust, and wind out of the big ears of listening post radar antennas being built by the Convair Division of General Dynamics Corporation. These flat-bottomed balloons are inflated by blowers and are used atop radar antenna towers, withstanding winds of more than 100 miles an hour. How about domesticating them? We have the slogan—"Every Home Should Own a Radome!"

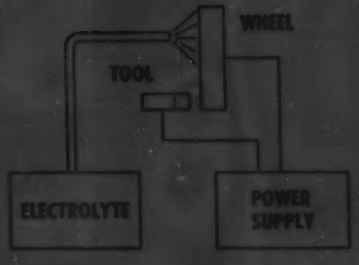
# NEW

## Reciprocating Electrolytic Tool Grinder

**MICRO-FINISHES CARBIDES, CUTS DIAMOND-WHEEL WEAR 80%**




59-25




**ELECTROCHEMICAL METAL REMOVING "LETS THE ELECTROLYTE DO THE GRINDING"**

As conductive, metal-bonded wheel reciprocates across face of tool, inexpensive salt-solution flows between the tool and the wheel, creating electrolytic cell; the tool becomes the anode. Material is removed essentially as in a deplating process—but at much higher speed—leaving burr-free finish.

**Because its reciprocating wheel just "wipes away" the carbide particles, Ex-Cell-O's Style 264 Electrolytic Tool Grinder reduces diamond wheel consumption by as much as 80 per cent! With one set-up, tools can be precision-finished to better than 15 micro-inches—free from heat checks, cracks or burns caused by abrasive contact.**

**The Style 264 grinds the cutting edges of carbides and other super-hard tool materials at one end, grinds chip breakers at the other. Wheel stroke is fully adjustable. Standard equipment includes: Ex-Cell-O Precision Spindle with inbuilt reversible motor, universal chip breaker fixture (shown in circled inset, above), and pressure system for electrolyte.**

**Write direct, or see your Ex-Cell-O Representative for details on the Style 264, conventional Style 142 Reciprocating Tool Grinder, and others in the complete Ex-Cell-O line.**

**EX-CELL-O CORPORATION**
DETROIT 32, MICHIGAN

XLO
EX-CELL-O FOR PRECISION
*Machinery Division*

EX-CELL-O PRECISION PRODUCTS INCLUDE: MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • THREAD AND GROOVE GAGES • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

# News OF THE INDUSTRY

## California, Texas and Washington

THOMAS L. REGAN has been named general superintendent of manufacturing for NORTH AMERICAN AVIATION'S Missile Division, Downey, Calif. Mr. Regan will have overall manufacturing responsibilities for the Air Force GAM-77 Hound Dog air-to-surface missile being built by the division.

JOSEPH T. RYERSON & SON, INC., Houston, Tex., announces that ALLAN F. EGGLETON has been named manager of sales of alloy, stainless, cold-finished carbon bar, and tubular steel. Appointed to sales districts in Houston are field representatives FRANK T. ELMGREN and JAMES L. ROBB. RUSSELL D. EVANS is assigned to the east Texas and Louisiana sales district as salesman.

ADAMAS CARBIDE CORPORATION, Kenilworth, N. J., has announced the appointment of WHITE BROS. Co., 304 Mullan Ave., Walla Walla, Wash., as an authorized Adamas distributor.

## Georgia and Florida

C. W. POWELL has been appointed manager, southern district, for METALLURGICAL PRODUCTS DEPARTMENT, General Electric Co., Detroit, Mich. Southern district headquarters are in Atlanta, Ga., where Mr. Powell will be in charge of Carboloy cemented carbide sales and service over an area including all of the southern states, parts of Kansas and Missouri, and the western states of Oklahoma, Texas, and New Mexico.



C. W. Powell, manager—southern district, Metallurgical Products Department, General Electric Co.

A. RICHARD BOYD has been promoted to district manager of the Atlanta, Ga., territory of CARPENTER STEEL CO., Reading, Pa. Mr. Boyd now manages the company's Atlanta warehouse and is responsible for sales of Carpenter specialty steels in six southern states.

JOHN O. CUSHING was appointed district manager, Atlanta, Ga. In his new post, Mr. Cushing will direct the sales and engineering services' activities for the manufacturer in its Atlanta district.

RALPH SCHWARZ, formerly president of Michigan Production Engineering Co., Detroit, Mich., announces the formation of FLORIDA PRODUCTION ENGINEERING CO. Key personnel have moved to FPE's new, larger facilities in Daytona Beach, Fla. Mr. Schwarz, FPE president, states he will specialize in the design and building of tools, dies, and special automated machinery.

## Illinois and Missouri

VERSON ALLSTEEL PRESS CO., Chicago, Ill., has announced the opening of a new company office in Detroit, Mich., to be headed by PAUL W. ECKSTEIN, district manager. It is located at 408 Lexington Building, 2970 W. Grand Blvd., Detroit, Mich.

Two dealer appointments have also been announced by the company. Lakeshore Machinery & Supply Co., 400 W. Laketon Ave., Muskegon, Mich., has been appointed exclusive representative for nine southwestern counties of the state of Michigan. Montague-Harris & Co., 893 Folsom St., San Francisco 7, Calif., has been appointed exclusive representative for the northern half of California.

CLEARING DIVISION OF U. S. INDUSTRIES, INC., Chicago, Ill., has appointed the following men to positions on the staff of its recently created Machine Tool Division. STEPHEN MILLER becomes sales manager, A. R. BURKE, assistant sales manager, and DAVID L. DUMOND, chief engineer, Machine Tool Division. In another appointment, KENNETH BRADLEY has become West Coast regional sales manager for Clearing Division. Mr. Bradley will be responsible for sales of the Clearing-Harrison and Clearing-Axelson lines of lathes.

PACIFIC SOUTHERN DIVISION of Link-Belt Co., Montebello, Calif., announces that CHARLES J. NAULTY has been appointed sales manager for the division. Mr. Naulty will serve as district manager for the Los Angeles sales territory which includes Arizona, southern California, southern Nevada, and three states of northern Mexico. He will also be sales manager for the Los Angeles plant at Montebello. He succeeds BENJAMIN M. PRESTHOLT, who has returned to the company's Caldwell plant in Chicago, where he will specialize in engineering sales for bulk materials-handling equipment.

SUNDSTRAND HYDRAULICS, division of Sundstrand Corporation, Rockford, Ill., has announced three new appointments in its sales and service organization. JOHN F. GRIFFEY is to work as a sales engineer in the Midwest. JAMES R. HOLMIN is being assigned to sales engineering responsibilities in the East. He will handle sales in all states on the Eastern Seaboard. RAY W. KIEFER has been appointed office service manager.

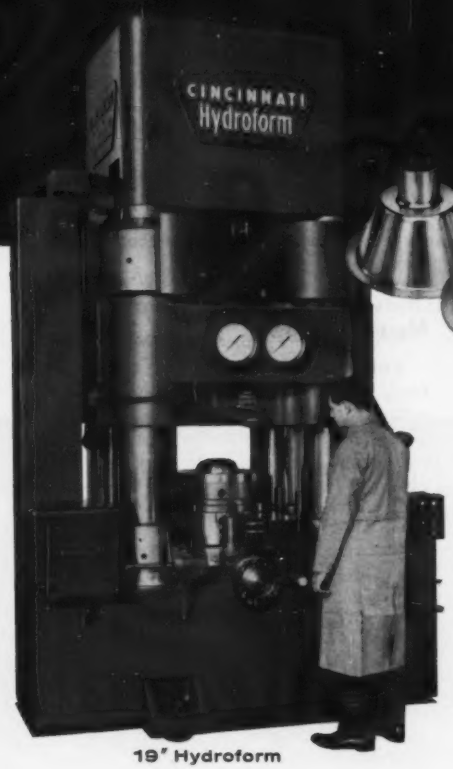
SOLAR CHICAGO DIVISION, U. S. Industries, Inc., Chicago, Ill., announces that ROBERT L. ALLEN has been named president of the division. The division, located in Chicago, engineers and manufactures tanks and pressure vessels for the oil, gas, chemical, and brewing industries.

ANDREW PRITZOS has been appointed sales representative for WALES-STRIPPIT, INC., Akron, N. Y., in the Midwest, covering the terri-

# With three Cincinnati® Hydroforms,

## producing precision formed development parts

## is quick at kaupp




19" Hydroform



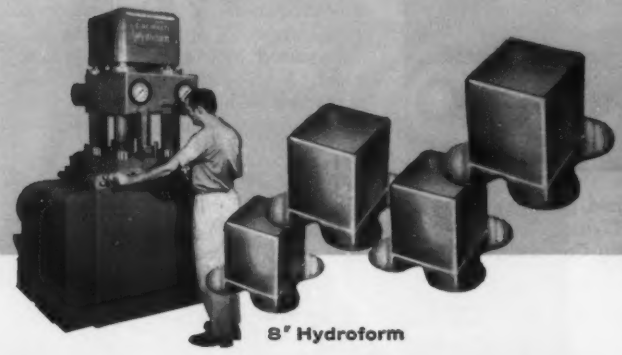
C. B. Kaupp & Sons, Maplewood, New Jersey, is a leading supplier of custom formed metal components, and has been since 1924. As a development shop, Kaupp found Hydroforming the ideal answer to faster, lower cost production of prototypes and pre-production drawn parts.

Hydroforming lowered tool costs . . . shortened time between release of drawings and the delivery of part samples . . . reduced the number of operations on most parts . . . and improved part quality. With 8", 12" and 19" size Cincinnati Hydroforms in operation, Kaupp assures customers fast, economical service.

Look into the advantages of Hydroforming for producing your metal parts and components. For detailed information, call in a Meta - Dynamics Division field engineer, or write for Bulletin M-1908-1.



12" Hydroform



8" Hydroform

**Hydroform**

**META-DYNAMICS DIVISION**

Machines for Metal Forming and Heat Treating

THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio, U.S.A.

CINCINNATI

tory consisting of Arkansas, Oklahoma, and parts of Kansas and Missouri. The Midwest division office of Wales-Strippit, Inc., a unit of Houdaille Industries, Inc., is located at 408 W. Madison St., Oak Park, Ill.

GEORGE J. DEUTSCH has been appointed manager of the Chicago district office of the CLARK CONTROLLER Co., Cleveland, Ohio. Clark's Chicago offices are located at 9107 W. Ogden Ave., Brookfield, Ill.

ROBERT W. SCHOEFFLER has been appointed field sales manager of MARSHALL & HUSCHART MACHINERY Co., Chicago, Ill.

LEON C. KOENIG was appointed vice-president of manufacturing by LINDBERG ENGINEERING Co., Chicago, Ill.

JOHN H. NELSON has been appointed vice-president in charge of sales at the KROPP FORGE Co., Chicago, Ill.

THEODORE F. ESERKALN has been appointed chief engineer of the ONSRUD MACHINE WORKS, INC., Niles Ill.

WILLIAM J. ELPERIN has been appointed manager of the St. Louis, Mo., office of the CLARK CONTROLLER Co., Cleveland, Ohio. Clark's St. Louis offices are located at 7 N. Brentwood Blvd.

## Michigan and Kentucky

WILLIAM J. PINKERTON has been appointed executive vice-president and assistant general manager of MICROMATIC HONE CORPORATION, Detroit, Mich. Mr. Pinkerton had been administrative vice-president of the company since 1957. In 1952 he was elected vice-president in charge of manufacturing. He joined Micromatic in 1942 as personnel director and for several years directed the advertising and personnel programs.

ROBERT E. LENAHAN has been appointed sales engineer in the middle Atlantic and New England states for BUHR MACHINE TOOL Co., Ann Arbor, Mich. Mr. Lenahan will represent Buhr's complete line. He will service companies in New Hampshire, Maine, Vermont, Massachusetts, Rhode Island, Connecticut, New Jersey, Delaware, most of Maryland, the eastern half of New York, and eastern Pennsylvania from his headquarters at Bibbins Road (R#1, Bridgeport), Easton, Conn.

LEONARD F. JOSEPH has been appointed factory representative for the state of Michigan by UNIMET CARBIDES, Chicago, Ill., division of United-Greenfield Corporation.

ROTO-FINISH Co., Kalamazoo, Mich., announced the appointment of JOHN R. STROM as chemist and process engineer for the company.

JOHN T. BACHMAN has been appointed a vice-president of JONES & LAUGHLIN STEEL CORPORATION'S Stainless and Strip Division, Detroit, Mich. He will be in charge of carbon and stainless strip sales; Kenilworth (N. J.) and Los Angeles warehouse sales; and sales activities of the Metallon Plant in Canfield, Ohio.

The FRAUENTHAL DIVISION of the Kaydon Engineering Corporation, Muskegon, Mich., announces that FRANK X. BUJOLD has been named general manager of the division. The resignation of RICHARD COUCH as vice-president of sales, Frauenthal Division, is also announced.

WESSON Co., Detroit, Mich., has appointed SAM T. GLEAVES as representative in Jefferson County, and WILSON INDUSTRIAL SUPPLIES, INC., as representative for the eastern half of Kentucky to represent all standard lines of Wesson carbide cutting tools and to cooperate in the design of special carbide cutting tools made by the Detroit firm. Sam T. Gleaves is located at 220 Wadsworth Ave., Louisville, and Wilson Industrial Supplies, Inc., at 550 W. 4th St., Lexington.

## New England

THE BAIRD MACHINE Co., Stratford, Conn., has appointed new distributors for the southern states, New Jersey, and Latin America. The new appointees are: the Dixie Mill Supply Co., New Orleans, La., to service southern Louisiana and Mississippi; Moore-Handley Hardware Co., Inc., to cover Alabama and Tennessee, with offices in Birmingham, Mobile, Chattanooga, and Nashville; Eaton Co. of Hackensack, N. J., to service northern New Jersey and part of lower New York; and Sabin St. Germain and Associates, Inc. of New York to handle all of Latin America, with branch offices in Mexico and principal South American cities.

DUANE E. STEINLE has been appointed eastern district sales manager of the LUCAS DIVISION, Cleveland, Ohio, of the New Britain Machine Co., New Britain, Conn. He will be headquartered at New Britain and will work with Lucas dealers in Boston, New York, Philadelphia, and Washington, D. C. These dealers include Wigglesworth Machinery Co., Boston; Harrington-Wilson-Daum Corporation, Mount Vernon, N. Y.; Delaware Valley Machinery Co., Willow Grove, Pa.; and J. H. Elliott Co., Washington, D. C.

GREENFIELD TAP & DIE, Greenfield, Mass., announces the appointment of A. F. MILLER, JR., to the new position of sales manager, threading tools and gages. He will be assisted by ARTHUR J. KELLEY, chief field service engineer, on threading tools, and PHILIP E. BITTERS, assistant sales manager, on gages.

JOHN J. HOBEN was elected to the newly created post of vice-president and operations manager for SCOVILL MFG. Co., Waterbury, Conn.



William J. Pinkerton, executive vice-president and assistant general manager, Micromatic Hone Corporation



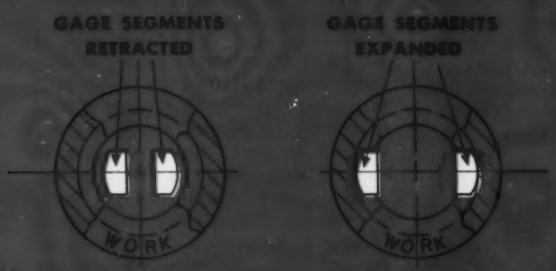
Frank X. Bujold, general manager, Frauenthal Division, Kaydon Engineering Corporation

# TO BE SURE OF ACCURACY

## . . . be sure it begins on a BRYANT SURFACE PLATE

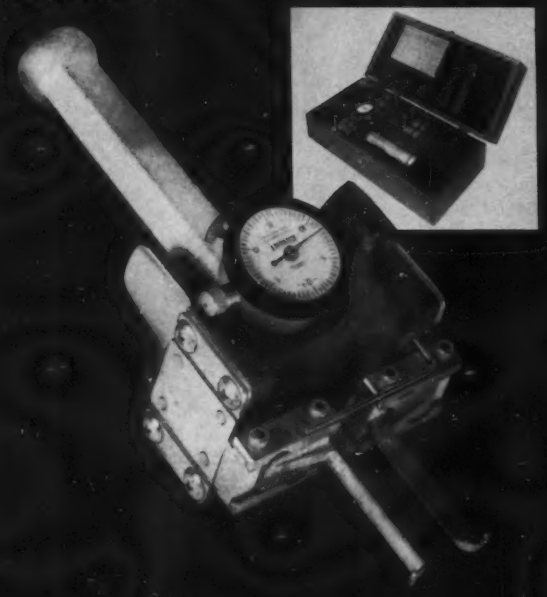
**Proved longer-lasting in impartial wear tests, Bryant Surface Plates provide clearly defined flatness plus surface-wide hardness and homogeneity. True savings come from Bryant-patented "head of the grain" finish and the finest Vermont quartz granite. Select from a variety of standard or special sizes, available with modern welded steel stands.**




**Releasing a thumb lever mates the stationary gaging segment and a movable segment to the groove; movable segment activates a precision dial indicator. Because there are no slides or pivots, dirt and cutting oil cannot affect operation.**

Complete Bryant Portable Groove Gage Kit checks snap ring grooves No. 25 to No. 500, and "O"-ring grooves No. 6 to No. 52.



## . . . be sure it's checked on a BRYANT GROOVE GAGE

**A precision-made portable gage for use at inspection bench or machine, the Bryant P-21 Groove Gage checks parts with snap-ring, "O"-ring or special grooves. Lightweight and easy to use, the P-21 gives visual comparator readings of groove diameter and roundness. Adjustable for diameters to 13", the P-21 Groove Gage is available with standard attachments and special accessories for checking concentricity of groove to bore diameter, for checking internal threads (in all tolerance classes and sizes from 5/16" to 5" diameter), and parts with special recesses, diameters or groove depth.**

**FREE FACT-FOLDERS—Engineering data and prices on the full line of Bryant Internal and External Thread and Groove Gages. Also—the full story of Bryant Granite Surface Plates; gives you *all* the facts before you buy!**

**EX-CELL-O CORPORATION**

*EX-CELL-O FOR PRECISION*

XLO

**Greenville Plant, 945 E. Sater St., Greenville, Ohio**

EX-CELL-O PRECISION PRODUCTS INCLUDE: MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • THREAD AND GROOVE GAGES • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT.

59-B-13



Charles E. Alling, marketing manager, the Bullard Co.

THE BULLARD CO., Bridgeport, Conn., announces the promotion of CHARLES E. ALLING to marketing manager. LOUIS JACOBELLI has been promoted to sales engineer to succeed Mr. Alling in Boston.

HEALD MACHINE CO., Worcester, Mass., has recently opened a new branch office in Syracuse, N. Y., established direct representation in Philadelphia, and added to its Cleveland sales staff FREDERICK J. UNDERWOOD, who will be branch manager in Syracuse. His office will be located at 2900 Erie Blvd. East, and will cover the area from Albany to Buffalo, south to Binghamton, and north to the Canadian border. Assisting Mr. Underwood in the new office as sales engineer is RICHARD A. MASTERS. Service representative assigned to the Syracuse office is ERNEST I. NIELSEN. A Philadelphia local sales office, operating under Heald's New York branch office, will be directed by ALBERT F. BUCKLEY. His office will be at 57 West Ave., Wayne, Pa., and will cover the Philadelphia-Camden area, Delaware, Maryland, and the District of Columbia area. The Cleveland branch office is enlarging its staff by appointing DONALD B. SAMPSON as sales engineer. Mr. Sampson will be located in Heald's office at 3669 Lee Road.

NORTON CO., Worcester, Mass., announces that DR. LOWELL H. MILLIGAN, its associate director of research and development, retired in September after 36 years with the company. Dr. Milligan has been responsible for many inventions and developments during his years with Norton. Among his inventions are the vitrified-bonded diamond grinding wheel and the first white commercial aluminum-oxide grinding wheels introduced to industry. KARL E. KROGSTAD has been appointed a field engineer at the Philadelphia district office of the company.

THE COGSDILL TWIST DRILL CO., INC., Greenfield, Mass., announces the appointment of ROBERT E. WALLACE as representative for the company's line of cutting tools in the Michigan area. GEORGE S. MILLER has been appointed representative for the company's line in the Cleveland area.

LELAND-GIFFORD CO., Worcester, Mass., announces the appointment of HILL PIERCE as sales engineer in the Detroit office. GORDON H. CARLSON was appointed sales engineer in the Chicago office. PAUL F. MIDDLETON has joined the company to take over Mr. Carlson's former position as sales engineer on bushings and hardened and ground parts.

BOSTON GEAR WORKS, Quincy, Mass., announces that JOHN H. O'NEIL, former head of Boston Gear's Cleveland branch, has been appointed assistant manager of field sales, operating from the Quincy home office. JOHN R. REARDON has been named Cleveland district manager.

RIVETT INC., Boston, Mass., has appointed RAY BOBBS AIR-DRAULICS, INC., 218 S. E. 12th Ave., Portland, Ore., as exclusive distributor in the states of Oregon and Washington for Rivett air and hydraulic valves, cylinders, and power units.

LOREN K. HUTCHINSON has been promoted to works manager for WYMAN-GORDON's Worcester, Mass., plant.

GEORGE P. BURNS has been appointed sales manager—machine tools for the VAN NORMAN MACHINE CO., Springfield, Mass.

## New York and New Jersey

U. S. INDUSTRIES, INC., New York City, has added to its group of foreign subsidiaries by the formation of a new company in England, called U. S. Industries, Inc. (Great Britain) Ltd. This new European company was established to initially coordinate the European activities of two of USI's principal divisions, the Clearing and the International Division. Clearing recently made an arrangement with T. S. Harrison & Sons, Ltd., of England, whereby Clearing sells Harrison engine lathes in the United States and other North American countries. The Board of the new USI British company consists of JOHN I. SNYDER, JR., chairman and president of USI, WALTER F. WILMAS, executive vice-president of USI, I. JOHN BILLERA, senior vice-president of USI, and the two resident joint managing directors of the new company, DONALD GILES and BERNARD C. SHRUBSOLE.

CARRA L. LANE has been appointed manager of plant operations for the CHICAGO PNEUMATIC TOOL CO., New York City. All manufacturing and engineering operations in the company's domestic plants at Utica, N. Y., Franklin, Pa., and Fort Worth, Tex., will be under his jurisdiction. In addition he will coordinate operations at the company's wholly owned subsidiaries: the JACOBS MFG. CO., West Hartford, Conn.; the ALLEN MFG. CO., Bloomfield, Conn.; and REICHDRILL DIVISION of Chicago Pneumatic Tool Co., Terre Haute, Ind. His headquarters will be at the company's home office in New York City.

LOEWY-HYDROPRESS DIVISION, Baldwin-Lima-Hamilton Corporation, New York City, announces that PAUL G. MAYER has been appointed general sales manager of the division. WILLIAM L. GOVAN, chief project engineer, was appointed to assume the additional functions of product sales manager for hydraulic machinery. GERALD L. SANDERS was appointed product sales manager, rolling-mill department of Loewy-Hydropress Division.

MORRIS MACHINE WORKS, Baldwinsville, N. Y., has revealed plans to construct a half million dollar modern industrial plant on its present building site. The new building is scheduled for completion in the spring of 1960.

CARL B. WILLE, formerly director of engineering for the CARBORUNDUM CO., has been promoted to general manager of the company's Curtis Machine Division, Niagara Falls, N. Y.

GEOFFREY PAGET was appointed chief metallurgist for the SHAW PROCESS DEVELOPMENT CORPORATION, Port Washington, N. Y.

WILLIAM G. "BILL" MOLES has been added to the sales force of the BURGMASTER EASTERN SALES DIVISION, Ridgewood, N. J., of the Burg Tool Mfg. Co., Gardena, Calif. His territory as direct factory representative for Burg Tool is the South, which includes the states of Maryland, Virginia, North and South Carolina,

Georgia, eastern Tennessee, and Florida. In addition, he handles all government accounts in the District of Columbia.

## Ohio

LAWRENCE J. O'CONNOR, JR., has joined the CLEVELAND CAP SCREW CO., Cleveland, Ohio, as sales manager, southeastern states. Mr. O'Connor will supervise Cleveland Cap Screw sales representatives and will be responsible for customer relations throughout the eight-state southeastern area, including North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Tennessee, and Louisiana. Mr. O'Connor will make his headquarters at 1014 Sampler Way in East Point, a suburb of Atlanta.

THE TIMKEN ROLLER BEARING CO., Canton, Ohio, elected D. A. BESSMER president to succeed WM. E. UMSTATTD. Mr. Umstattd, although retiring as president, will continue to serve as a director and as chairman of the executive committee. H. E. MARKLEY will advance from vice-president to executive vice-president to succeed Mr. Bessmer. The company also announced several other changes. H. H. TIMKEN, JR., formerly executive vice-president, will continue to be chairman of the board of directors. W. R. TIMKEN is relinquishing the title of vice-president, but will continue to serve as chairman of the finance committee.

The company will build a new railroad-bearing producing facility in its Columbus plant. Present estimates indicate that the line will be in operation by the fall of 1960.





(Left) C. Thorpe Thompson, director, vice-president, and general manager; and (right) W. Fay Aller, director and vice-president—engineering, Sheffield Corporation

SHEFFIELD CORPORATION, Dayton, Ohio, has named C. THORPE THOMPSON director, vice-president, and general manager. W. FAY ALLER has been appointed to the board of directors and promoted to vice-president of engineering at the staff level. Mr. Aller has served in important capacities with the company for over a quarter of a century.

HERBERT W. MURRAY has been appointed district manager of distributor sales in the Pittsburgh territory for Parker-Hannifin Corporation, Cleveland, Ohio. Mr. Murray's district is comprised of western Pennsylvania, West Virginia, and the eastern tier of Ohio counties.

CARL P. CRONK has been named to further implement the expanded original equipment sales and research activities of the ELECTRIC AUTO-LITE CO., Toledo, Ohio, in the newly created post of manager, market research.

FLOYD C. JENNESS retired as machinery sales-service manager of the NATIONAL ACME CO., Cleveland, Ohio, as of August 1, after forty-three years of service.

DONALD F. ROSS has been promoted by the CARPENTER STEEL CO., Reading, Pa., to Dayton-Cincinnati district manager.

## Pennsylvania and District of Columbia

CARPENTER STEEL CO., Reading, Pa., has promoted two men in the Cleveland and Buffalo district offices. CHARLES H. HARTON, formerly district manager in Buffalo, becomes district manager in Cleveland, covering also the Toledo and Pittsburgh areas. JAMES H. MAGEE, formerly assistant branch manager in the Cleve-







(Left) D. A. Bessmer, president, (center) Wm. E. Umstattd, director and chairman of executive committee, and (right) H. E. Markley, executive vice-president, Timken Roller Bearing Co.

land territory, now moves to Buffalo as branch manager. FENTON R. MITCHELL, JR., has been named assistant branch manager of the New York and Bridgeport, Conn., warehouses of the company. He will assist the district manager in operation of these branches. FRANK X. MCTAMNEY has been promoted to assistant branch manager in the Philadelphia area.



R. H. Stebbins, sales manager, Gisholt Machine Co.

GISHOLT MACHINE CO., Madison, Wis., has announced three changes in sales personnel. WILLIAM NYBERG succeeded R. H. PRESNALL as district manager of Gisholt's direct-sales office in Pittsburgh, Pa. Mr. Presnall has been promoted to assistant sales manager at Gisholt, Madison. R. H. STEBBINS was named sales manager. He has been with the company since 1939.

SKF INDUSTRIES, INC., Philadelphia, Pa., has announced the appointment of THOMAS W. MORRISON as director of engineering and research. Mr. Morrison takes over active direction of the company's Engineering Division and Research Laboratory. Both organizations were under direction of vice-president GUNNAR PALMGREN, who is completing nearly forty years of SKF service as he prepares for retirement. Mr. Palmgren will serve as vice-president and special consultant to the president through the end of the year.

ROLLE MFG. CO., Lansdale, Pa., has been acquired as a wholly owned subsidiary by DEK INDUSTRIES, INC., New York City. R. CARTER DYE, succeeding ZACHARY W. REDD, has been elected president of Rolle Mfg., and FRED H. EDGAR, executive vice-president. Mr. Edgar also is executive vice-president of DEK Industries. WILLIAM E. NOLAN has been elected vice-president and general manager of the new subsidiary, and DOUGLAS D. LAWSON was elected vice-president in charge of sales.

TEXTILE MACHINE WORKS, Reading, Pa., announced that KENITH STRUNK has been elected to fill the newly created post of vice-president of research and engineering at its Wyomissing plant. Mr. Strunk will be responsible for the coordination of all engineering operations, in which he will be assisted by Textile's chief engineer, G. BITZER.

A. LEE GRAHAM, for eleven years plant superintendent of the AMERICAN FORGE & MFG. CO., McKees Rocks, Pa., has been named vice-president in charge of operations.



A. Lee Graham, vice-president—operations, American Forge & Mfg. Co.

The American Machine Tool Distributors' Association announces that its new headquarters will be at 1500 Massachusetts Ave., N. W., Washington 5, D. C.

* * *

## Motion Picture Reviews

FASTENER APPLICATION

A new 16-millimeter color motion picture film, entitled "New Fastening Methods," is now available from Huck Mfg. Co., 2480 Bellevue Ave., Detroit 7, Mich. The thirteen-minute film promotes the assembly line concept of fastener application.

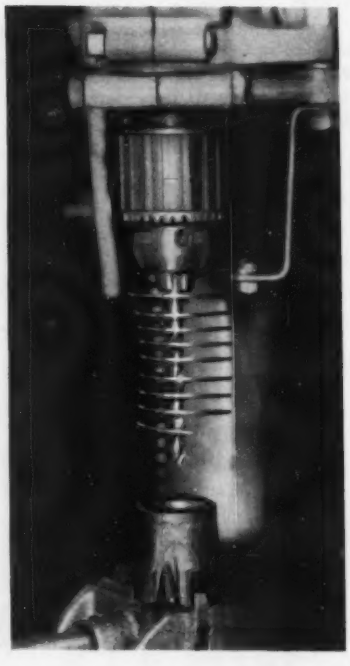
Featured in the film is the Huckbolt fastener as it can be applied to railroad cars, truck trailers, steel and aluminum buildings, submarines, aircraft, and missiles. Unusual close-ups of the fastener in cross-section show how the Huckbolt collar is swaged into locking grooves on the pin. This sequence is a variation of the "time-lapse" technique of photography which shows the condition of the collar at various stages during fastener installation. The magnification in these scenes is such that flow lines of the collar metal are clearly visible.

FERROALLOY PRODUCTION

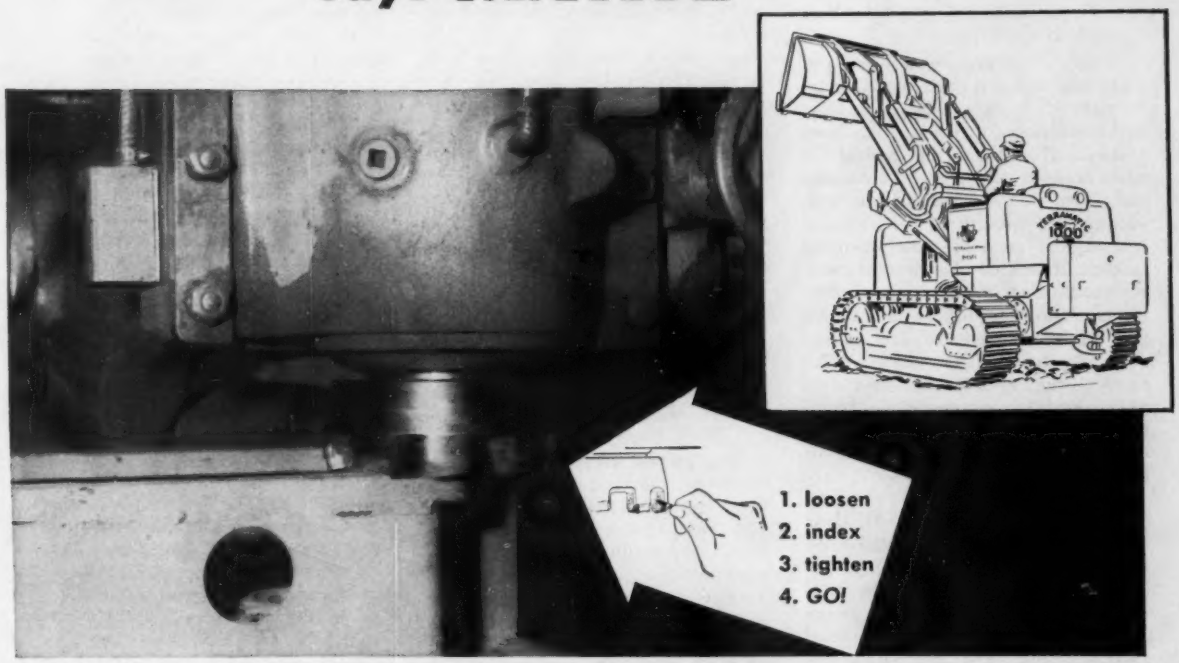
A pioneer film for the ferroalloy industry has been released by Vanadium Corporation of America, 430 Lexington Ave., N. Y. C. This 16-millimeter color motion picture presents in its twenty-three-minute duration a complete story covering operations of the company from the mining of ore to the shipment of finished products. The film also shows how "Vancoram" products are used by the iron and steel industry and, in turn, how these products are ultimately utilized in the modern world.

* * *

**A spring supported beneath the chuck of a drill press protects operators from broken tools and flying chips at the St. Thomas, Ontario, plant of the Timken Roller Bearing Co. When the chuck is lowered, the spring is compressed, and makes an effective shield, yet permits the work to be observed. The spring expands when the chuck is raised, but still encloses the revolving tool. The device is simple, foolproof, and requires no maintenance.**



# Milling Cutters are dependable says J.I.CASE




## 16 months of continuous milling on TERRAMATIC transmission housings

It's no "pink tea party" when you chew a quarter-inch of rough 1015 Weldment Steel casting — spinning the milling cutter at 800 s.f.p.m. That milling cutter's got to be tough — *plenty tough* — and the carbide inserts need real "backbone."

J. I. Case found the right combination in V-R Face Mill Cutters with V-R throw-away carbide inserts. Big demand for Case Terratrac dozers, diggers, and crawlers, with Terramatic Transmission, has kept production lines humming — 2 and 3 shifts a day — 16 months continuous production. In this picture there's no place for excessive downtime, or delays for tool regrinding. V-R Face Mill Cutters provide cutting edges right on the job — a turn of a wrench — index the insert to a new cutting edge — tighten — and away you go! (Minimum maintenance problems, too: in *16 months production only 3 sets of main screws and 1 chip breaker plate needed replacing.*)

Your V-R representative has the facts on Face Mill Cutters and all carbide cutting tools — call him in today or send for Catalog VR-58.



**Vascoloy-Ramet corporation**

PRIME MANUFACTURERS OF REFRACTORY METALS ENGINEERED FOR THE JOB

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For more data, circle this page number on inquiry card

# New Books and Publications

DESIGN OF INDUSTRIAL EXHAUST SYSTEMS. Third Edition. By John L. Alden. 256 pages; 137 illustrations; indexed; 6 by 9 inches; cloth. The Industrial Press, 93 Worth St., New York 13, N. Y. Price, $6.

A new third edition of Design of Industrial Exhaust Systems brings up to date through extensive revision and expansion a text which has been a standard reference in its field for more than twenty years. New material takes note of the advances in variety and quality of devices and techniques available for meeting modern standards of industrial environment. Fog filters, reverse-flow filters, venturi scrubbers, and multiple miniature cyclones are among developments freshly treated. The third edition updates the basic text to account for increasing appreciation of sound engineering principles relating to control and cleaning of industrial air.

Subjects covered include: fluid flow; hoods of all types with their characteristics and specifications for various operations; duct (piping) system design; dust separators with characteristics of various types, pneumatic conveyors; fans; system detail and planning; and field measurements and their interpretation.

Although written by an engineer for engineers, this volume is nevertheless a clear guide to contractors, building owners, hygienists, or anyone concerned with the industrial environment, showing how to design, build, or buy an exhaust or air-cleaning system. Typical of its practical value are the drawings and detailed specifications for hoods serving a wide variety of industrial situations.

MECHANICS—Part I: Statics. Second Edition. By J. L. Meriam. 393 pages; 6 by 9 1/4 inches; illustrated. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $5.

This is one volume of a well-known two-volume work which has undergone thorough revision based on an extensive and detailed survey of first edition users. The emphasis on practical and interesting problems is continued and strengthened. About 50 per cent of the problems have been replaced with new ones carefully patterned after design situations from a wide variety of engineering activities. Greater attention is given to illustrations which promise to advance the level of engineering representation in mechanics to new standards. In both volumes a chapter on vector methods has been added so that the notation of vector algebra and vector calculus may be employed if desired. In Part I: Statics, the treatment of fluid statics has been completely rewritten, and the topic is introduced from the three-dimensional aspect at the start to help clarify this problem. Another change is the deletion of the chapter on beams and its replacement by articles dealing with beams in the chapters on structures and distributed forces.

MACHINE TOOLS FOR ENGINEERS. Second Edition. By Charles R. Hine. 445 pages; illustrated; 6 by 9 inches. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price, $7.75.

This second edition covers every important machine tool, arranges it in its proper category, and defines and compares each machine tool type. In addition, it gives many examples of actual cuts, speeds, production times, and other valuable data. The pictorial material attempts to give the student an idea of actual processes which he could otherwise obtain only from personal inspection trips. The new edition also contains a new chapter on automatic machine tools.

WELDING HANDBOOK. Section II, Gas, Arc & Resistance Welding Processes. Edited by Arthur L. Phillips, cloth bound; 550 pages; 6 by 9 inches. Published by American Welding Society, 33 W. 39th St., New York 18, N. Y. Price, $9.

The Second Section of the Fourth Edition of the Welding Handbook covers gas-, arc-, and resistance-welding processes and includes a chapter on standard welding symbols.

The volume contains thirteen chapters, 845 illustrations and nearly 100 tables. Each chapter has its own bibliography and reference is simplified by a very comprehensive index.

A chapter is devoted to each process, or group of processes, and each group is followed by a chapter describing the equipment. The treatment of the arc-welding process, for example, includes chapters on carbon-electrode arc welding, shielded metal-arc welding, inert-gas metal-arc welding, and submerged arc welding, as well as a single chapter describing bare metal-arc welding, impregnated-tape metal-arc welding, and atomic-hydrogen welding. This group of chapters is followed by a chapter on arc-welding equipment which covers the machines and equipment used for all the arc-welding processes described.

An entire chapter is devoted to welding symbols, the shorthand of the welding industry.

COATED ABRASIVES—MODERN TOOL OF INDUSTRY. Sponsored by Coated Abrasive Manufacturers' Institute. 426 pages; 6 by 9 1/4 inches; illustrated. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price, $8.50.

This is a comprehensive and authoritative guide to the use of coated abrasives in industry, covering their nature, advantages, applications, and efficient methods of use.

The book shows how the abrasives are manufactured, and describes all factors of their effective use in the metalworking (ferrous and non-ferrous), woodworking, glass, and plastics industries, in applications ranging from heavy material removal to fine polishing.

There is comprehensive coverage of many recent advances, including new automatic machinery, and applications such as strip scouring, preplate finishing, and contour finishing. Also discussed are such special topics as cutting oils, coolants, and lubricants specifically for use with coated abrasives.

# Coming Events

OCTOBER 20-22—Sixth Annual Conference on Lubrication, jointly sponsored by the American Society of Lubrication Engineers and the American Society of Mechanical Engineers, will be held at the Sheraton-McAlpin Hotel in New York City. For additional information write to the American Society of Lubrication Engineers, 5 N. Wabash Ave., Chicago 2, Ill.

NOVEMBER 2-6—Forty-First National Metal Exposition and Congress to be held at the International Amphitheatre, Chicago, Ill. It is under the management of the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio; Chester L. Wells, director.



# Background For Perfection

Gages do "tell the story" of perfect threads. But back of *that* story you will find holes perfectly drilled, taps properly selected and correctly used, and engineering services freely given.

When tooling any threading job, get the whole story — specify GREENFIELD cutting Tools *and* GAGES.

***Write for Greenfield Handbook —"Facts About Taps and Tapping."***

INDUSTRIAL DISTRIBUTOR
SERVING INDUSTRY ECONOMICALLY
THE RIGHT HAND OF PRODUCTION

## GREENFIELD TAP & DIE

GREENFIELD, MASSACHUSETTS



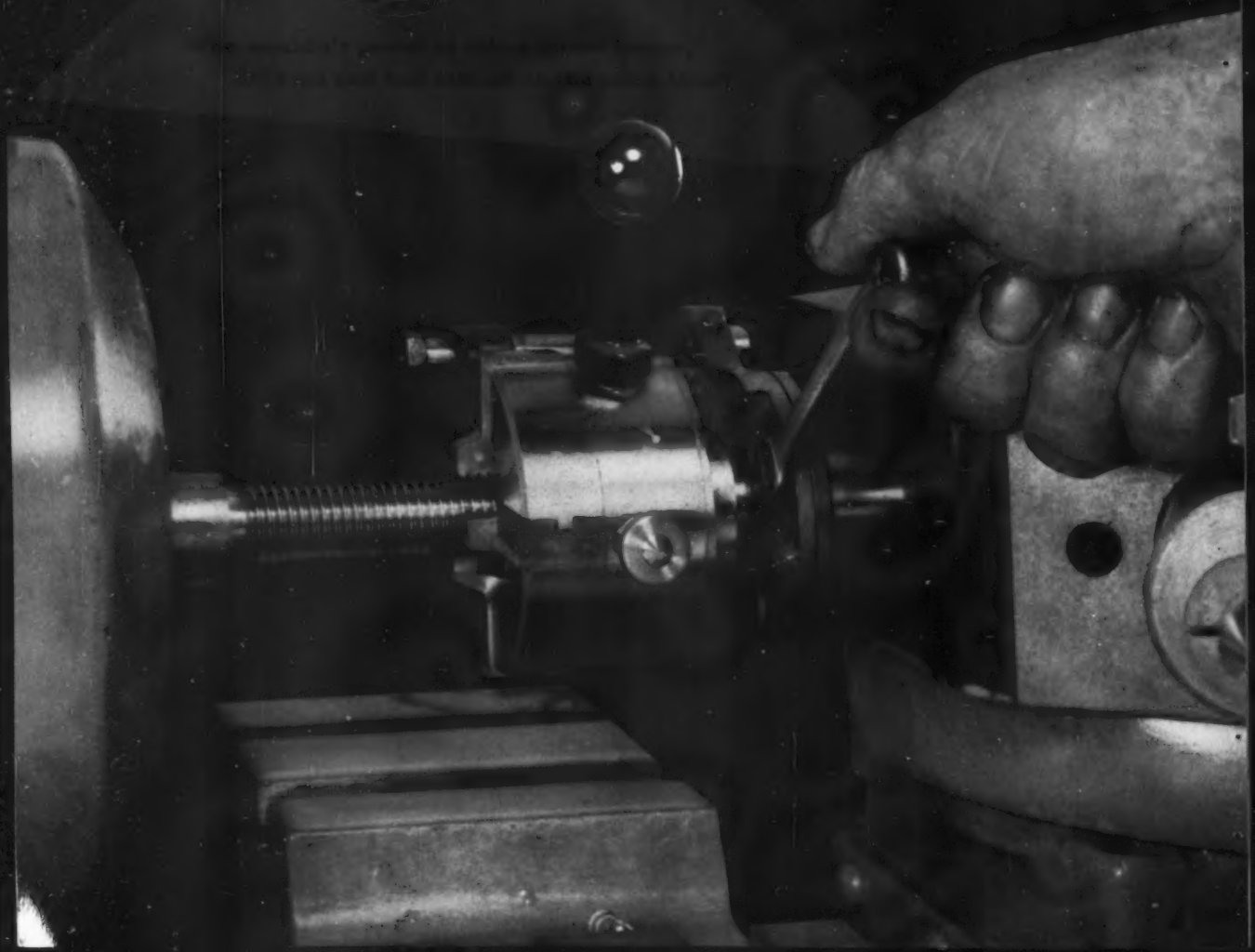
Look around your plant, you'll probably find nobody toting those bars and lifting those bales but be sure you are not trying to produce today's precision threads with antique or worn out die heads. Chances are that a new Geometric would give a lift to more than one threading job.

CALL YOUR GEOMETRIC DISTRIBUTOR TODAY



GEOMETRIC HORTON

NEW HAVEN 15, CONNECTICUT



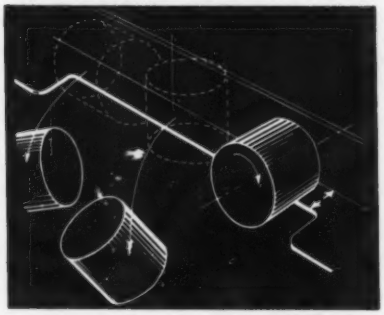
# practical automation ideas....no. 3

### Storage Unit that Thinks for Itself!

When should a part be stored temporarily between operations? When should it pass immediately to the next operation? A Gear-O-Mation storage unit makes this decision after checking if the loader is full. It either positions the part on the loader for immediate processing, or puts it in "storage" for later demand feeding.

### Impossible!—But it Works!

An orientor that repeals the law of gravity? Impossible? Maybe, but Gear-O-Mation has one that's hard to believe.



Parts roll down an "L"-shaped track which narrows to *slightly less than one-half width of part!* Correctly rolling parts roll on across for further processing; others just tumble off and go back to the start of the track.

**What's your concept of automation? A vast array of inter-connecting machining operations untouched by human hands? Actually, all automation comes down to a series of small devices—feeders, orientors, escapements, conveyors, etc. Dozens of typical devices are illustrated in Gear-O-Mation's "Idea File". Ask your Gear-O-Mation field engineer to show you his.**

### Magnetic Handling with Fabric Belt

Small irregular shaped parts can be elevated or directed into orientors with fabric belts backed by permanent magnets in such a way that only those correctly positioned will enter the demand-feed chute.

### Single Loader for Multiple Feeder

Where it is desired to load parts into a multiple feeder (as for a heat-treat oven) they can be picked off a single chute, dropped into a multiple "Velvet-Drop" (patented) feeder which keeps all channels of the multiple feeder loaded, provides temporary storage to keep them full.

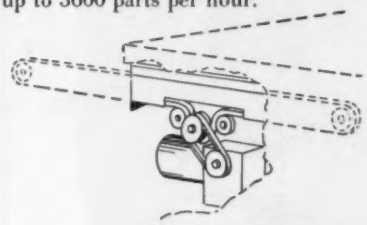
**Most people think of automation as something built into the original installation. That's a good way to do it, but you don't have to do it that way. If you want to automate your existing operation this can be done very effectively, too. In either case, Gear-O-Mation's experts can automate your machining operation to any degree desired—make it deliver all of the potential designed into it.**

### Track: Fast, Clear and Adjustable!

A simple answer to handling parts of different dimensions—as when a design change is made—is an adjustable-track conveyor. Side plates and rails are moved in or out, quickly adjusted for smaller or larger part width. Parts roll on spring steel rails. Soils, chips, cuttings, etc., fall through, making the conveyor self-cleaning.

### One Belt Does Two Jobs

Sometimes you can use the same belt to unload parts from one machine and load them into another by using a center drive gear head motor with a wrap-on sprocket. A typical Gear-O-Mation installation of this type handles up to 3600 parts per hour.



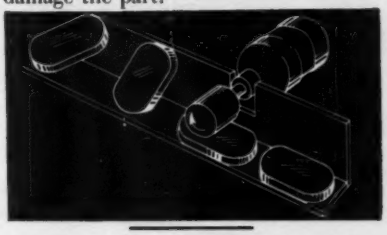
**Automation begins with the coupling of two machines, often through a simple elevator and a gravity chute. From this you can go almost to infinity. Gear-O-Mation has the experience and ingenuity to point the way and design the equipment for the exact degree of automation your operation requires and warrants.**

### Handling Parts in Pre-Set Groups

In automation, parts don't have to be handled one-at-a-time only. Sometimes it works better to process them in groups of preset quantities, using a feeder that meters and releases the precise number required. For example, in one plant, eight plastic fishing reels are aligned and placed on a spindle for simultaneous group winding.

### Pencil Wheel Orientor

A small grinding wheel can be used to orient light parts by knocking down all parts which try to pass in an upright position. The light 'bite' of the wheel gives positive action but does not damage the part.



**Gear-O-Mation doesn't believe in its customers having to pioneer untried ideas. Where a new principle is involved, we make sure of it first. Mostly, however, we go back to established principles we all KNOW will work.**

### Demand Storage for No-Roll Parts

Where parts can't roll you can move many rows of them through storage by a simple, moving disc with fixed guide rails. One such Gear-O-Mation unit collects, stores and feeds up to 3000 small parts.

### NEW "IDEA FILE"

**Every Gear-O-Mation field engineer now carries with him an "Automation Idea File." It contains sketches and details of practical answers to many parts handling problems—orienting,**




**feeding, positioning, conveying, distributing, etc. These ideas will suggest variations to suit your exact needs. Have a Gear-O-Mation field engineer go through the "Idea File" with you soon! Use the handy coupon below.**

**GEAR-O-MATION**
DIVISION OF MICHIGAN TOOL COMPANY
7171 E. McNICHOLS RD. • DETROIT 12, MICH.

GEAR-O-MATION
Division of Michigan Tool Company
7171 E. McNichols Rd., Detroit 12, Mich.

Yes! I want to see the time- and money-saving ideas in your new "Idea File." Have your field engineer show it to me soon!

Name_____
Company_____
Street_____
City_____



For more data, circle this page number on inquiry card

# Product Directory

**To find headings easily, look for capital letters at top of each page to denote location.**

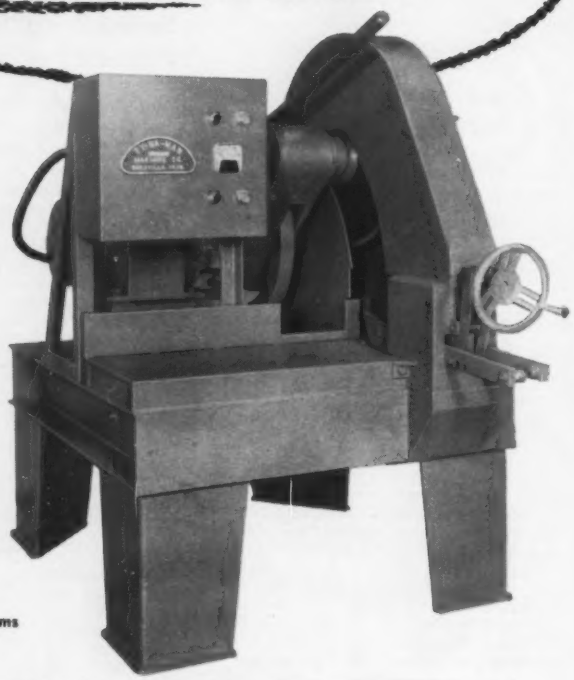
**ABRASIVE CLOTH, Paper and Belt**
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.

**ABRASIVES, Disc**
Gardner Machine Co., Beloit, Wis.
Macklin Co., Jackson, Mich.
Norton Co., 1 New Bond St., Worcester, Mass.

**ABRASIVES, Polishing, Tumbling, Etc.**
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Macklin Co., Jackson, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.

**ACCUMULATORS, Hydraulic**
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Wood, D. D., 1072 Public Ledger Bldg., Philadelphia 5, Penna.


**New 30HP "CHOP" Saw Ends UNDERPOWER Problems**



Cuts
Steel structurals
Bar stock
Heavy cable
Pipe
Test sections
Forging blanks
Extrusion blanks
High temperature alloys
Rigging steel
Fixtures and jigs
Cross ties
Heavy wooden beams

Now . . . power *when* you need it—*where* you need it—with the radically new 30 HP "CHOP" Saw for wet or dry cutting. Advanced features include more powerful main motor, sealed-bearing spindle, timing belt drive, and a new dynamic suspension system that permits light fingertip feed without springs, counterweights or adjustments. Provides straight or variable-speed oscillating feed at option of operator. Screw-operated double vise quickly adjusts to handle up to 8" x 8" sections or solids.

**Ty-Sa-Man**
SINCE 1885

**Write for FREE BROCHURE**
**TY-SA-MAN Machine Co., Inc.**
**1093 White Ave., Knoxville, Tenn.**


**AIR GAGES, Dimensional**—See Gages Air Comparator

**AIR GUNS**
Chicago Pneumatic Tool Co., New York, 17, N. Y.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

**AIR TOOLS**—See Grinders, Portable, Pneumatic—Drills, Portable, Pneumatic, Etc.

**ALLOY STEELS**
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Tool Steel Co., Chicago Hts., Ill.
Jessop Steel Co., Washington, Penna.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

**ALLOYS, Bearing**
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Mueller Brass Co., Port Huron, Mich.

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Ryerson & Son, Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.

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General Electric Co., Schenectady 5, N. Y.

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**ARBORS AND MANDRELS**
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Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill. (end mills)
Cincinnati Milling Machine Co., Milling Mch. Div., Marburg Ave., Cincinnati 9, Ohio
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
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**BACTERICIDES**
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Oakite Products, Inc., 26 Rector St., New York 6, N. Y.

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DoALL Co., Des Plaines, Ill.
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Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Jessop Steel Co., Washington, Penna.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

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**BEARINGS, Ball**
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Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearings Co., Inc., Paughkeepsie, N. Y.
Hoover Ball & Bearing Co., Ann Arbor, Mich.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., 30th & Hunting Park Ave., Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
S K F Industries, Inc., Philadelphia, Penna.

**BEARINGS, Bronze and Special Alloy**
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Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio

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Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

**BEARINGS, Roller**
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International Ball & Roller Bearing Corp., 3123 Eastlake, Seattle 2, Wash.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Rollway Bearing Co., Inc., 541 Seymour St., Syracuse, N. Y.
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Sonnet Tool & Mfg. Co., Hawthorne, Calif. (Milling Machine, arbor)
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Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Rollway Bearing Co., Inc., Syracuse, N. Y.
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**BENCH CENTERS**
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Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

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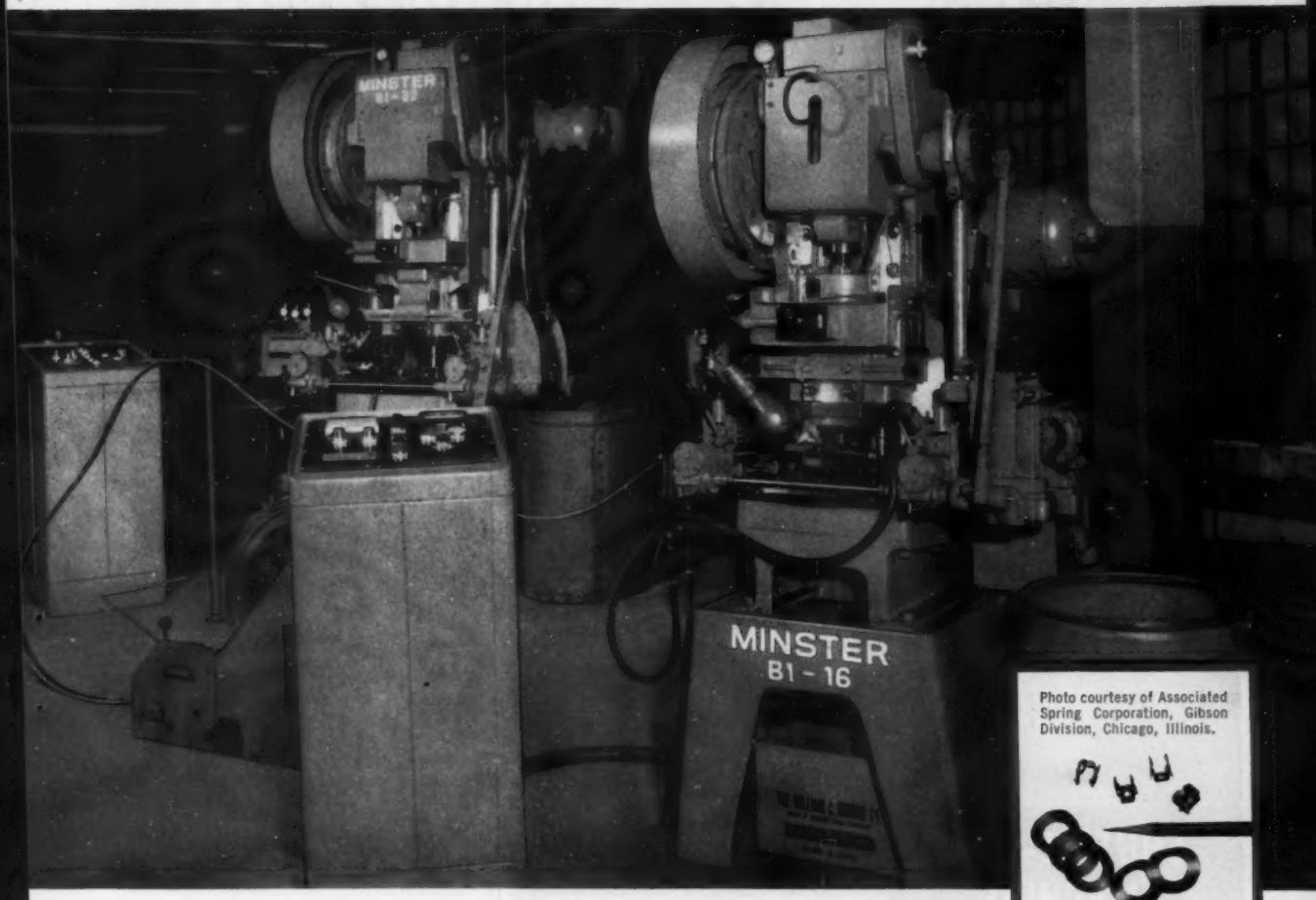



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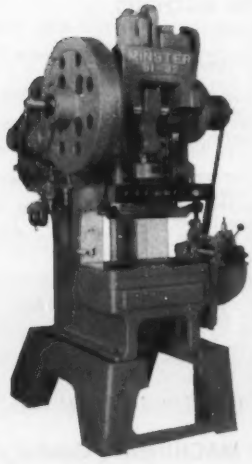
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Hydraulic Press Mfg. Co., Mount Gilead, Ohio
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Northwestern Tools, Inc., 115 Hollier Ave., Dayton 3, Ohio.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Trans National Fabricators Corp. (T.N.F.), 1052 E. Elizabeth Avenue., Linden, N. J.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

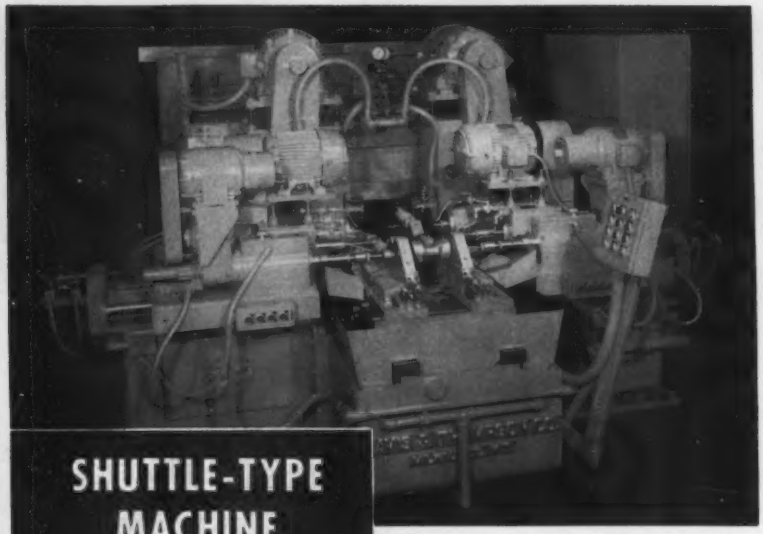
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DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
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Metallurgical Products Dept. of General Electric Co., Box 327, Roosevelt Park Annex, Detroit 32, Mich.
Universal Engineering Co., Frankenmuth 2, Mich.
Van Norman Machine Co., 3460 Main St., Springfield 7, Mass.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio
Universal Engineering Co., Frankenmuth 2, Mich.
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Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
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Cross Co., P.O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Davis & Thompson Co., 4460 N. 24th St., Milwaukee 10, Wis.
DeVlieg Machine Co., Fair St., Royal Oak, Mich.
Ex-Cell-O Corp, 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray Co., G. A., 3611 Woodburn Ave., Cincinnati 7, Ohio
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.

*(Continued on page 264)*

SHUTTLE-TYPE MACHINE HANDLES OVER 40 DIFFERENT VALVE PARTS

**. . . Mills, Centers, Tap Drills and Taps in #316 Stainless**

Here's a good example of engineering a semi-standard machine to handle a lot of parts. Although this machine has been adapted to milling, centering, drilling and tapping of valve parts, its basic design lends itself to other operations through the addition of various types of heads as well as multiple spindle drill heads. Machine incorporates hydraulic controls for table feed and index, two milling heads, two hydraulic power heads, each with center drill and tap drill spindle, and two mechanical screw feed tapping heads to accommodate 16, 20 and 24 pitch threads. Capacities range from ⅜" to 4½" diameter, 5" to 23" long. Parts are inner valves for liquid level controls of tough #316 stainless steel.

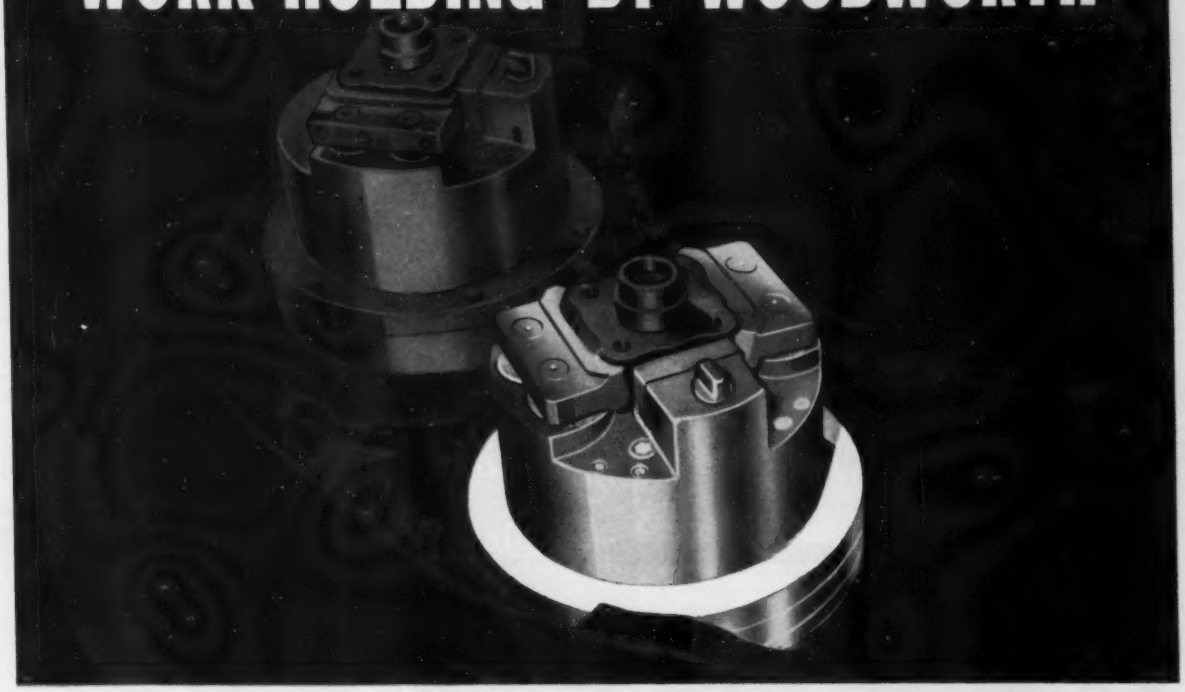
If you need high production of one part or moderate production of many parts *with a minimum capital outlay,* it will pay you to call in a D & T production engineer. There is no obligation for this service.

**FREE DATA**
Write for Bulletin 1002.



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**KELSEY-HAYES COMPANY** in Detroit, one of industry's major automotive parts suppliers, each day produces hundreds of wheel hubs using N. A. Woodworth Company's revolutionary new **"BALL-LOK"** Chucks. An actual on-the-job photograph (above) shows an application in Kelsey-Hayes' hub and drum machining department where 4 Bullard Multi-Matic machines are equipped with 32 Woodworth **"BALL-LOK"** Chucks. Here rough castings of the wheel hub and flange are bored, turned, faced, reamed and drilled.

**The Woodworth "BALL-LOK" Heavy Duty Power Chuck presents an entirely new principle in chucking. The jaws are actuated through a ball joint which minimizes friction losses and provides a pull-back action to the jaws.**

- **The "BALL-LOK" has tremendous gripping force — a 5 to 1 ratio on the drawbar pull.**
- **Completely sealed and lubricated jaw actuating mechanism eliminates wear problems inherent in all other power chucks.**
- **T Slots, where master jaws in other designs wear out, are completely eliminated in the "BALL-LOK".**
- **Both "Draw-Bar" and air operated "BALL-LOK" Chucks are available.**

**MAINTENANCE SAVINGS WILL PAY FOR YOUR WOODWORTH "BALL-LOK" CHUCK**

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Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., Lansing, Mich.
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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., Fair St., Royal Oak, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati 7, Ohio
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio
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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
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Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.

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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. Y.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

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Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

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Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

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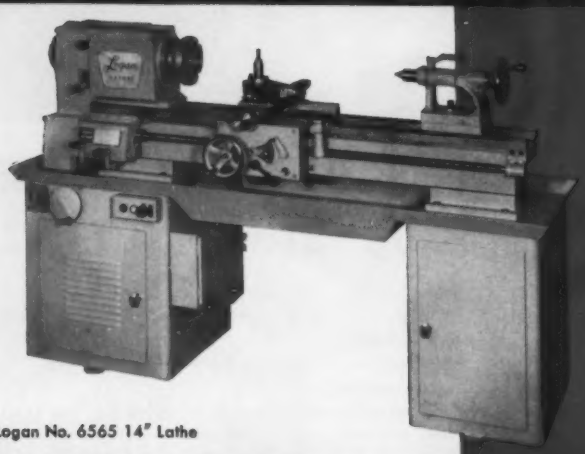
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its specifications add up to high production capacity

Logan 14" Lathe



Logan No. 6565 14" Lathe

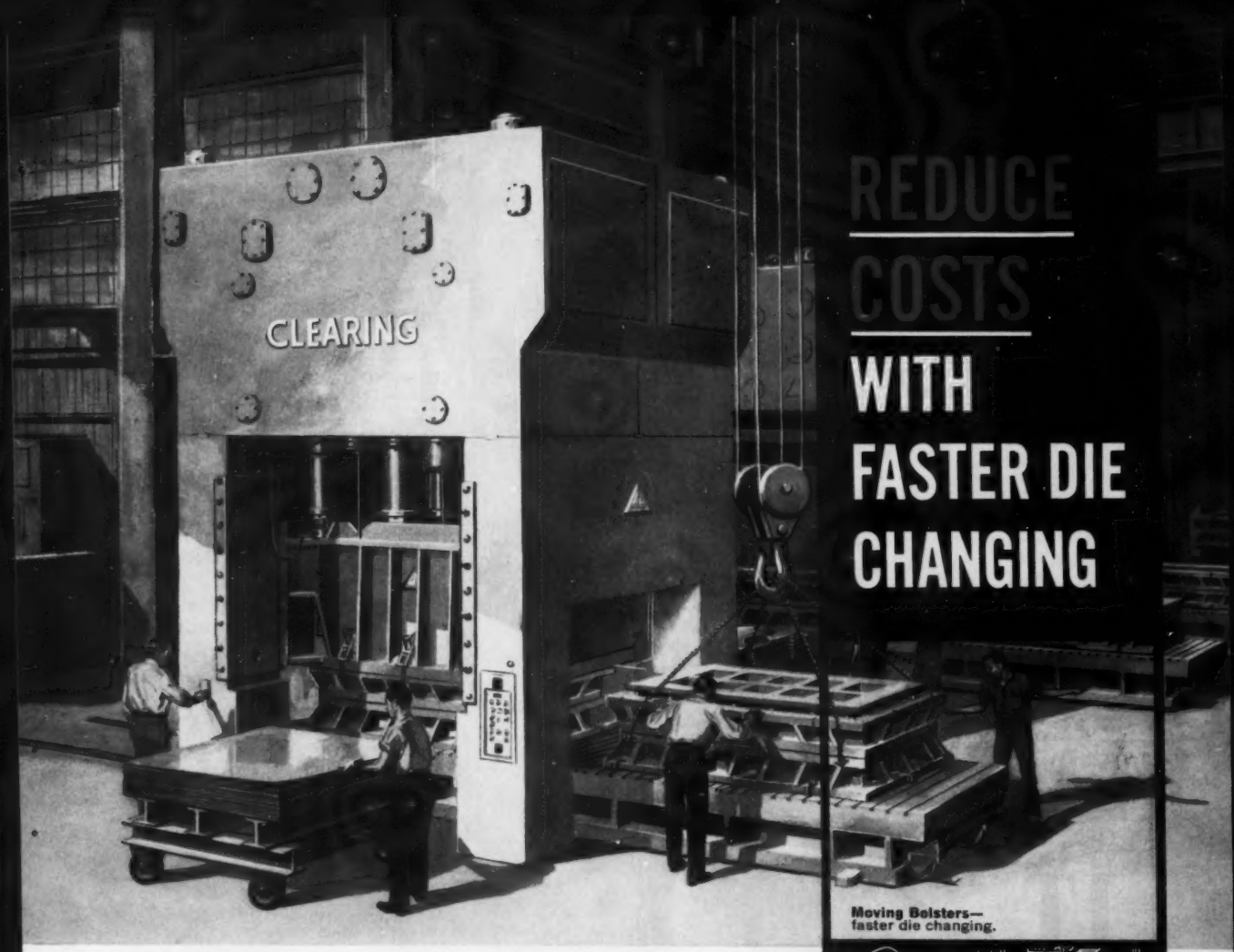
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*Find out how the many cost-shattering features of this line can benefit YOU. Write for bulletins on Moving Bolster press lines.*



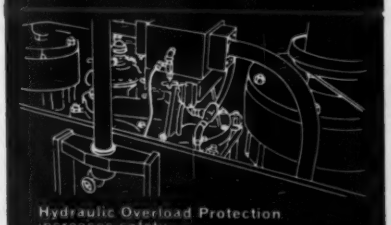
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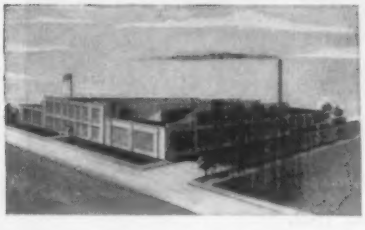


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Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.

**BURRING MACHINES**—See Deburring Machines

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**BUSHINGS, Drill Jig**
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metal Corbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio
Universal Engrg. Co., Frankenmuth, Mich.

**BUSHINGS, Hardened Steel**
Universal Engrg. Co., Frankenmuth, Mich.

**BUSHINGS, Non-ferrous and Powdered Metal**
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio
Universal Engrg. Co., Frankenmuth, Mich.

**CALIPERS, Spring, Firm-Joint, Transfer, Hermaphrodite, etc.**—See Layout and Drafting Tools Machinists' Small Tools

**CALIPERS, Vernier**
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. Y.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

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Rowbottom Machine Co., Waterbury, Conn.

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# AGAIN





P-K Internal-Fin Coolers can be furnished insulated with Rock Cork laid in asphalt and covered with a heavy steel jacket. Illustration shows insulated cooler.

# Revere helps fit the metal to the job

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Because of its unique design, the Patterson-Kelley Freon Water Cooler shown at right above saves space, requires less Freon, while its reduced weight and size mean lower cost.

With the P-K Type FO Internal-Fin Freon 22 Water Cooler the installation can be designed for a shell 2 diameters less and 1 to 2 feet shorter than with conventional plain or bare tube coolers. This is made possible by the use of ¾" O.D. x .035" gauge Revere copper tube drawn over a Revere aluminum extruded fin as shown above. Serrated surface of the fin enhances refrigerant vaporization.

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**REVERE COPPER AND BRASS INCORPORATED**

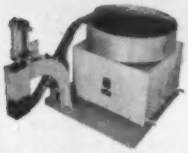
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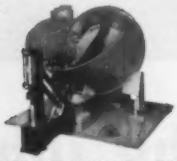



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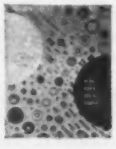
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Linde Co., 30 E. 42nd St., New York 17, N. Y.
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

**CASTINGS, Die**
American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wis.

**CASTINGS, Non-ferrous**
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Mueller Brass Co., Port Huron 35, Mich.
Shenango Furnace Co., Dover, Ohio
Textile Machine Works, Reading, Penna.
Vascoloy-Ramet Corp., Waukegan, Ill.

**CASTINGS—Gray Iron, Malleable**
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Hill Acme Co., 1201 W. 65 St., Cleveland 2, Ohio
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Malleable Castings Council, 1800 Union Commerce Bldg., Cleveland 14, Ohio
Shenango Furnace Co., Dover, Ohio
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Textile Machine Works, Reading, Penna.

**CASTINGS, Steel, Stainless, etc.**
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Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
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Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit, Mich.
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**CHAINS, Power Transmission and Conveyor**
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**CHUCKING MACHINES, Multiple-Spindle Automatic**
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Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cross Co., P.O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.

*(Continued on page 270)*



# Tool Steel Topics

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.



## Lehigh H Teams Up with Brake Die

### *Result: 150,000 Box Tops*

The job was a tricky one. It called for the blanking and forming of .010-in. black plate into hinged tops for children's paint boxes. But with the black plate already lithographed, it was imperative to avoid marring the material.

The manufacturer, Sobel Metal Products Co., Easton, Pa., talked it over with his local Bethlehem tool steel distributor, Luria Steel Supply Co., Catasauqua, Pa. The Luria representative proposed the use of Lehigh H for the die, and Brake Die for the punch. This proved a wise choice, for combined, the two tool steel grades turned out 150,000 pieces without any need for redressing. And the black plate received nary a scratch.

Bethlehem Lehigh H (AISI D-2) is our easy machining high-carbon, high-chrome tool steel. It is an air-hardening grade, with plenty of wear-resistance thanks to its excellent carbide distribution. Brake Die, a grade of special analysis steel, is oil quenched and tempered to develop the mechanical properties needed for maximum wear and toughness.

Bethlehem regularly produces about 30 different grades of tool steel—a range so wide as to meet virtually every requirement. For full information, call your Bethlehem tool steel distributor.

## BETHLEHEM TOOL STEEL ENGINEER SAYS:



### *Hot-Work Tools Last Longer When Thermal Stress Is Reduced*

Deterioration of hot-work tools in service by heat checking or cracking depends largely on the severity of thermal stress developed in service. Anything which can be done to decrease the magnitude of the thermal stress will increase the service life of the tools.

One of the most essential steps in using hot-work tools is to preheat them to their normal working temperature before use. This seemingly insignificant step will often improve the tool life appreciably because it decreases the severity of the initial stress cycles.

The provision of multiple tools which are used in succession is another simple way to decrease thermal stresses on certain types of hot-work tools. For example, on piercing operations the press may be provided with as many as six piercing punches mounted on an indexing fixture. After each piercing operation a different punch is moved into position for the next operation. This permits each punch to cool during the time of the next five operations, greatly reducing the severity of thermal stress. The service life of punches used in this manner is often twice that of punches used continuously in the same operation.



*Air-4 hardens in air at 1550F.*




## *With AIR-4 You Get Air-Hardening at Low Temperatures . . . FREE MACHINING . . . EXCELLENT WEAR*

Air-4, Bethlehem's new medium-alloy tool steel, hardens in air at 1550F, and has excellent free-machining properties due to its carefully controlled addition of lead. It has exceptional wear-resistance and high toughness. Moreover, it can be heat-treated with complete freedom from the dangers of cracking. Ask your Bethlehem tool steel distributor for complete information on Air-4.




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Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

**CHUCKING MACHINES, Single-Spindle Automatic**
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Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
Sunastrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio

**CHUCKS, Air Operated**
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

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Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jacobs Mfg. Co., West Hartford 10, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Universal Engrg. Co., Frankenmuth 2, Mich.
Warner Engrg. Co., Frankenmuth 2, Mich.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

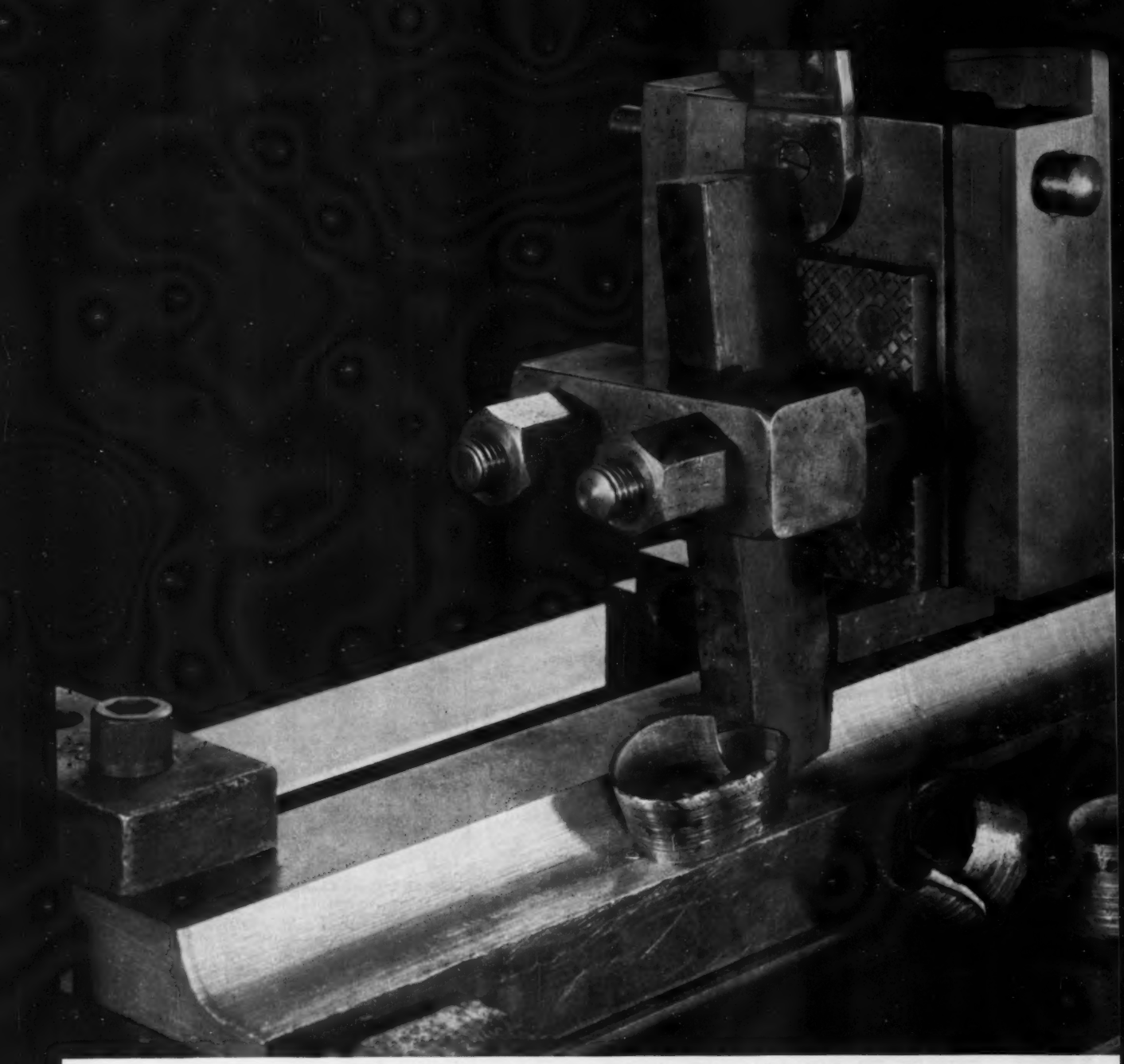
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Geometric-Horton Div., United Greenfield Corp., New Haven, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
L.W. Chuck Co., Toledo 4, Ohio
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

**CHUCKS, Compensating**
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

**CHUCKS, Diaphragm**
Woodworth, N. A. Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

**CHUCKS, Drill, Key Type**
Jacobs Mfg. Co., West Harford, Conn.

**CHUCKS, Drill, Keyless**
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*Machining gib for heavy duty lathe from cold rolled steel. Depth of cut: ¾"; feed: .060"*

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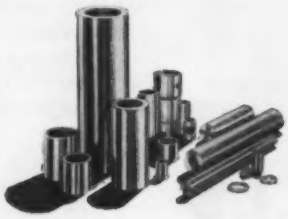
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Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

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Geometric-Horton Div., United Greenfield Corp., New Haven, Conn.
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Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
L-W Chuck Co., Toledo 4, Ohio
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Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio

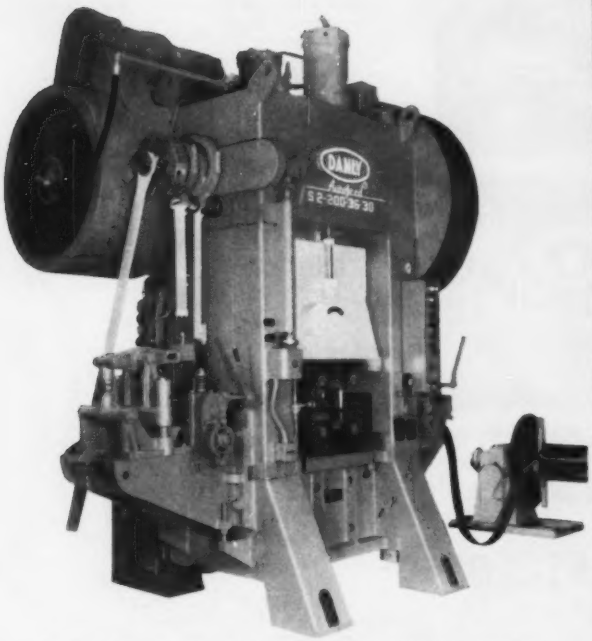
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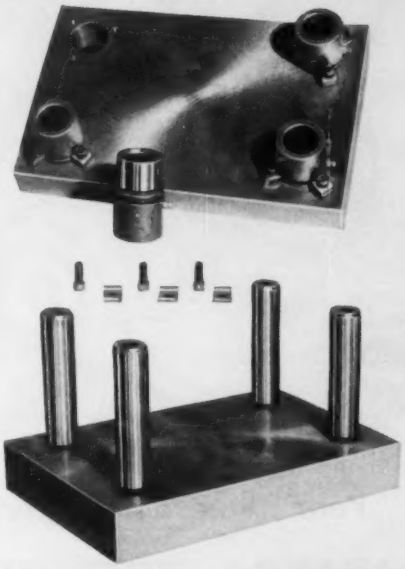


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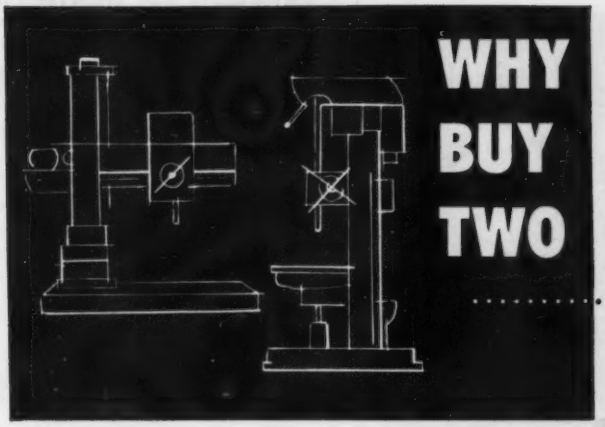
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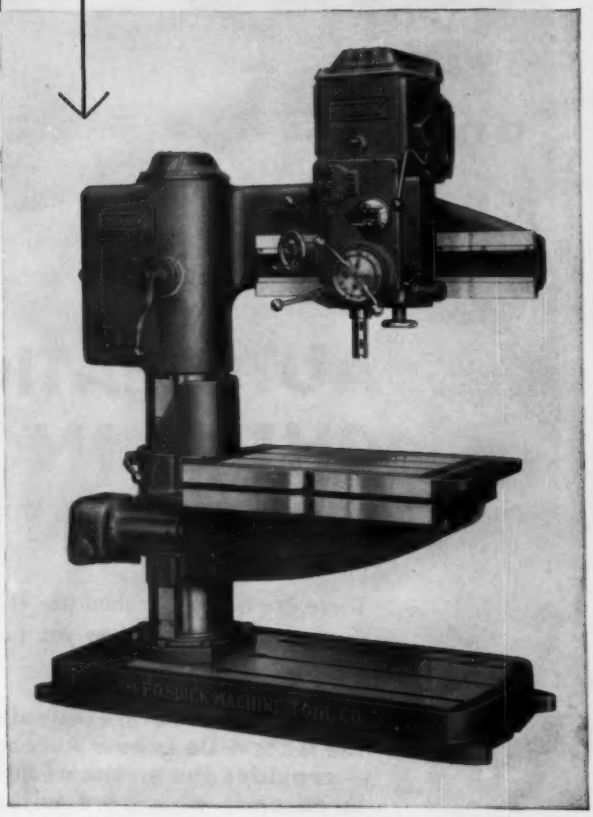
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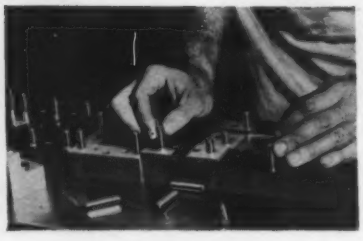


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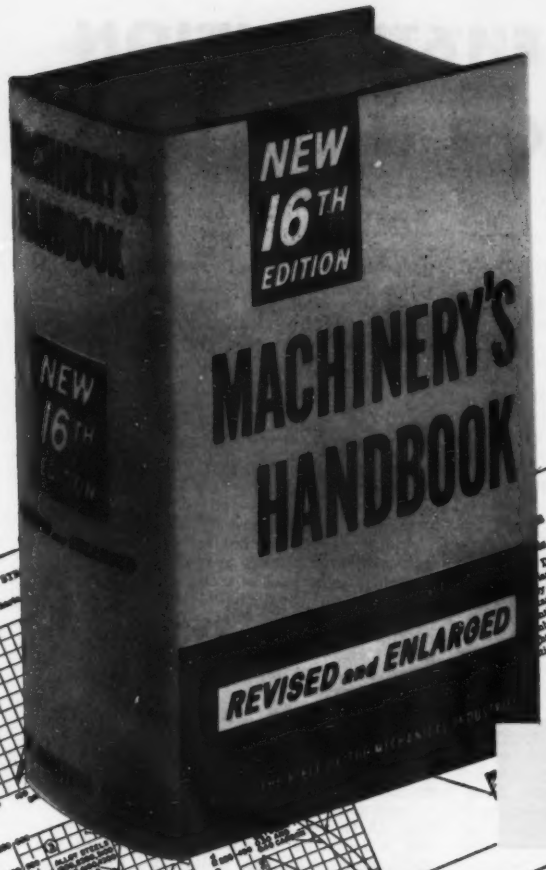
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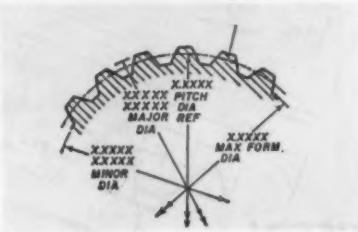
# THE 16TH EDITION ON THESE AND




**Since the publication of the 15th Edition of MACHINERY'S HANDBOOK, widespread time-saving and money-saving advances in metalworking technologies, techniques and standards have taken place. Here are just some of the topics that have been added to the 16th Edition to help you keep abreast of the changes and developments in the ever-progressing metalworking industry. Only a NEW Handbook can meet the needs of today's designing and metalworking jobs . . . help *you* move up to a better, more responsible position in your industry.**

**SCREW THREAD SYSTEMS.** Probably the most widely used section in the Handbook, it has been completely revised to reflect the latest changes in screw thread standards. Contains dimensional data for all classes of Unified threads including the several new thread series recently added. The extensive tabular data and detailed discussion of Unified threads are useful to both the machinist and the designer. These tables present data for new Unified thread series and include hole sizes for tapping Unified threads based on the new minor diameter tolerances. Data are given for the manufacture and specification of Unified threads, the new Unified miniature screw threads, new dimensions for interference fit threads (studs), Acme screw threads, Stub Acme screw threads, and microscope threads. Complete diagrams for each of these threads show the disposition of allowances, tolerances and crest clearances.

**GEARING.** The subject of gearing has always been given careful attention in MACHINERY'S HANDBOOK. Advances in fine-pitch precision gearing called for the inclusion of this kind of detailed information: enlarged spur and helical gears from 7 teeth up, composite error inspection, checking pressures, indicator limits, angular position errors, angular backlash, and a complete tubular description of data for specification on drawings. . . . This is the first handbook to give the *exact* formula and tables of data for the selection of helical gear milling cutters in the production of milled gears for experimental and replacement purposes.




**INVOLUTE SPLINES AND SERRATIONS.** The widespread use of involute splines and serrations in place of straight splines has necessitated a new 43-page section giving complete design data, formulas, and dimensions in tabular form for the design, production, and specification of the various types of involute splines and serrations. As an aid to the draftsman, several pages are devoted exclusively to detailed drawing specifications for the various types of spline and serration fits. Tables of wire sizes and wire measurement data for involute splines and involute serrations are also included. The effect of spline errors on spline fits, error allowances and tolerances, and machining data pertaining to splines are also clearly explained and illustrated.

**TWIST DRILLS.** Included in this section are data on combined drills and countersinks, jobbers length millimeter drills, and other new data from the revised American Standard for twist drills.

**PHYSICAL PROPERTIES OF STEELS.** Heat-treated steels have been found to have the same tensile and yield strengths regardless of composition and alloying elements so long as they have been fully hardened to the same as-quenched hardness. Charts make it possible to determine expected tensile strength, reduction in area, yield points, and tempering temperature if the hardness of a particular steel is known. Strength data for a wide range of ferrous and non-ferrous metals are also given.

**BALL, ROLLER, AND NEEDLE BEARINGS.** This 72-page section gives standard description and dimensional data for all types of ball, roller and needle bearings. Besides dimensional and tolerance data for inch and metric bearings, there are data pertaining to shaft and housing fits, clamping and retaining methods, bearing life, radial and thrust load ratings, selection procedure for ball and roller bearings, equipment loads, bearing capacity, and bearing lubrication.



**TAPS AND THREADING DIES.** New designations, applicable to ground thread taps, have been added to this section which includes dimensions of all types of taps and dies. Recommended tap limits to achieve the various classes of fits in the Unified thread series are also included.

**TAP DRILLS.** Complete dimensional data have been included on drilled holes for Unified and Unified miniature internal threads, as well as for the old American Standard thread classes.

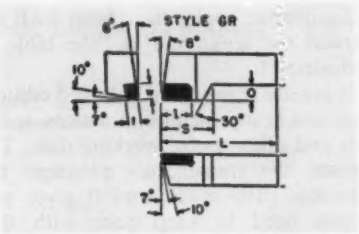
**KNURLING AND KNURLING TOOLS.** Complete data concerning the diametral pitch knurls recommended as providing good tracking by the American Standard are presented. Includes tolerances for work diameters before and after knurling.

**CARBIDE BORING TOOLS.** Standard data for solid and tipped carbide boring tools, as published in the latest American Standard, have been included because boring tools differ in many respects from other single-point cutting tools.

**FLAT BELTS.** The continuing popularity of flat belts in certain applications has been given consideration in 16 new pages, complete with diagrams for cutting, lacing and installation of these belts.

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**SINGLE-POINT CUTTING TOOLS.** Added to this section are data on solid carbide inserts and their holders, with complete dimensions for each. These are the carbide cutting tools included in the latest American Standard.




**SELF-TAPPING SCREWS.** Data on drills and punched holes for self-tapping screws and the application of the various types of screws are presented.

**TAPERS.** Data on Morse stub taper shanks have been added to the already extensive taper-shank section of the Handbook.

**SCREW THREAD INSERTS.** Screw thread inserts including the self-tapping type are now widely used to achieve strong threads in soft materials, as well as for replacement of stripped threads.

**TAPER PINS.** To facilitate the machining of taper holes for taper pins a new chart has been provided showing drill sizes for step drilling prior to taper reaming.

**GROOVED PINS.** Dimensions of standard grooved pins have been given.

**BOLTS, SCREWS, NUTS, WASHERS.** Among the changes in this section are new American Standard dimensions for plain washers and toothed lock washers and clearances for box, open-end, and socket wrenches.

**GRINDING, POLISHING, AND LAPPING.** This new 54-page section provides the latest in available data, techniques, and process descriptions in connection with grinding wheels, wheel dressing, centerless-, surface-, cylindrical-, offhand- and portable-grinding. Tables of grinding troubles give recommendations for their correction. Descriptive data facilitate the selection of proper grinding wheels.

**METAL JOINING, CUTTING AND SURFACING.** This completely new 36-page section deals with soldering, brazing, hard facing, welding, flame cutting, arc-cutting, etc. In addition to detailed descriptions of each of these processes, convenient tables aid in the selection of the best process for the operation at hand. Explains brazing of high-speed steel tips to carbon steel shanks.

**V-BELTS AND SHEAVES.** The increasing use of V-belt drives is reflected in the new 17-page section dealing with such topics as: light-duty drives, belt cross-sections, sheave dimensions, horsepower ratings, multiple V-belts, V-belt installation, service factors, operating speeds, idlers, V-flat drives, double-angle V-belts, and selection procedure.

**TRANSMISSION CHAINS.** A section of 41 pages provides coverage of transmission roller chains and silent chains. Discussed are: sprockets, chain parts, keys, keyways, set-screws, center distance between sprockets, length of chain, cutting sprocket tooth form, sprocket materials, cutters for sprocket teeth, horsepower ratings, design procedure, chain designations and dimensions, drive ratios, chain selection, etc.

**FLYWHEELS.** Because the flywheel is so important as a source of energy for punching, shearing and other shop operations as well as a means of providing a uniform flow of energy in rotating engines, new data pertaining to the design of flywheels are given. This takes account of centrifugal stresses, combined stresses, and residual stresses. Of primary importance are the two up-to-date tables of safe speeds for flywheels in accordance with American Standard and insurance company requirements.

**STRENGTH OF MATERIALS.** The data given on the strength of materials, or mechanics of materials, take the guesswork out of determining the most economical size and shape of machine parts or structures to meet strength and deflection requirements. In addition to formulas and data that apply to straight beams and columns, new sections have been added, giving formulas and tables for curved beams such as are used in machine frames; pipe columns; round, rectangular, and square plates; cylinders subjected to internal and external pressure; tubes, and shells.

**SHAFTS.** Formulas and directly applicable tables for strength and horsepower capacity, as well as considerations of torsional and linear deflection for various conditions of loading, are given in detail. Included are formulas for critical speeds of rotating shafts, formulas for shafts of brittle materials, and data for the effect of keyways on shaft strength.

**STANDARDS.** Data and information from the latest American Standards have been included, wherever possible throughout the wide range of Handbook topics. Comparable data and information from a large number of British Standards have also been given to provide a reliable reference on British practice.

**SPRINGS.** The data for designing and winding springs have been supplemented by a new section giving a detailed description of the most widely used spring materials, their strengths, moduli of elasticity, service factors for various applications, endurance limits, and working stresses at elevated temperatures.

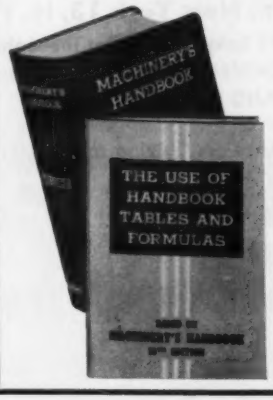
**PLAIN BEARINGS.** A complete section on the factors to be considered in the design and selection of plain bearings, as well as a step-by-step procedure utilizing simple charts and formulas, has been provided as a guide for the designer. In addition to complete tables of alloys for both solid and sintered bearings, information on wood bearings, plastic laminate bearings, rubber bearings and others is given and the procedure for babbitting bearings in the shop is explained in detail.

**INVOLUTE FUNCTIONS.** Involute functions of angles have been established as the most convenient means for solving certain problems in gear design and measurement. A complete set of involute functions from 14 to 58 degrees in increments of one minute and to as many as seven decimal places is provided.



**WIRE ROPE.** Some of the topics covered in this new 17-page section are: installation, safe working loads, factors of safety, sizes, simplified practice recommendations, drum and reel capacities, maintenance, lubrication, replacement.

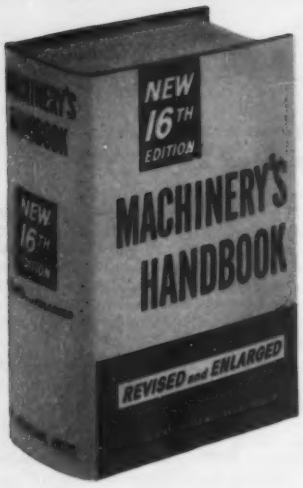

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National Acme Co., 170 E. 131st St., Cleveland, Ohio.

**DIES, Thread Cutting**—See Stocks and Dies

**DIES, Thread Rolling**
Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio.

**DIE STEELS**
Jessop Steel Co., Washington, Penna.

**DISINTEGRATORS**
Cincinnati Milling Machine Co., Milling Mch. Div., Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Elox Corp. of Michigan, Troy, Mich.

**DIVIDERS AND TRAMMELS**—See Layout and Drafting Tools

**DIVIDING HEADS**—See Indexing and Spacing Equipment

**DOWEL PINS**
Allen Mfg. Co., Bloomfield, Conn.
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Producto Machine Co., 985 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

**DRAWING COMPOUNDS**
Oakite Products Inc., 26 Rector St., New York 6, N. Y.
Stuart, D. A. Oil Co., Ltd., 2727 S. Troy St., Chicago 23, Ill.

**DRESSERS, Grinding Wheel**
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

**DRIFT KEYS**
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
DoALL Co., Des Plaines, Ill.

**DRILL HEADS, Multiple Spindle**
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 15 Watson Ave., Springfield 1, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Jarvis Corp., Middletown, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Richmond, Ind.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

**DRILL HEADS, Unit Type**
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp, Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Snow Manufacturing Co., Bellwood, Illinois.




**DRILL SLEEVES AND EXTENSION HOLDERS**

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Automatic Tool Co., Inc., S. 7th & N Sts., Richmond, Ind.

**DRILLING ATTACHMENTS, Multiple Spindle—See Drill Heads, Multiple Spindle, and Vises, Machine**

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Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Watson Ave., Springfield, Mass.
Buhr Machine Tool Co., 839 Green St., Ann Arbor, Mich.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Ettco Tool Co. Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Kaukauna Machine & Foundry Div., Biddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., S. 7th and N Sts., Richmond, Ind.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
Townsend, H. P. Mfg. Co., Elmwood, Conn.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

**DRILLING MACHINES, Automatic**

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Davis & Thompson Co., 4460 N. 12th St., Milwaukee 10, Wis.
Edlund Mchry. Co., Div., Cortland, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Olivetti Corp. of America, 42-33 Northern Blvd., Lond Island City 1, N. Y.
Olofsson Corp., Lansing, Mich.
Snow Manufacturing Co., Bellwood, Ill.
Wales-Strippit, Inc., Akron, N. Y.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

**DRILLING MACHINES, Bench**

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio.
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Edlund Machinery Co., Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 9th St., Hamilton, Ohio.
Homestrand, Inc., Larchmont, N. Y.
Leland-Gifford Co., Box 989, Worcester, Mass.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.

**DRILLING MACHINES, Deep Hole**

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Berthiez, Charles, 5 Rue Montalivet, Paris, France.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Wales-Strippit, Inc., Akron, N. Y.

**DRILLING MACHINES, Gang, Multiple-spindle**

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 4460 124th St., Milwaukee 10, Wis.
Edlund Machinery Co., Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 136 12th St., Rockford, Ill.
Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio.
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester, Mass.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.


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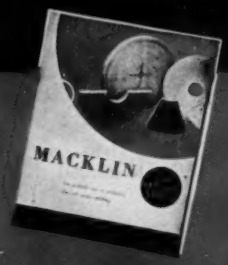
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Burg Tool and Mfg. Co., Inc., 15001 Figueroa, Gardena, Calif.
Carlton Mch. & Tool Co., 2961 Meeker St., Cincinnati 25, Ohio
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Homestrand, Inc., Larchmont, N. Y.

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Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Burg Tool and Mfg. Co., Inc., 15001 S. Figuera, Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Edlund Machinery Co., Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Leland-Gifford Co., Box 989, Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Snow Manufacturing Co., Bellwod, Illinois.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Wales-Strippit, Inc., Akron, N. Y.

### DRILLING MACHINES, Universal Radial

Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.

### DRILLING MACHINES, Upright

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes, W. F. & John Co., Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Burg Tool and Mfg. Co., 15001 S. Figueroa, Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St.,
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwoukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Ill.
Wales-Strippit, Inc., Akron, N. Y.

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Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Circular Tool Co., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cogsdill Twist Drill Co., Greenfield, Mass.
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

### DRILLS, Core

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
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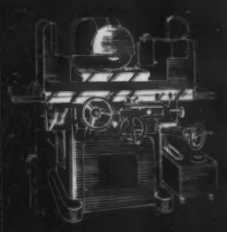
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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
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Chicago Pneumatic Tool Co., New York 17, N. Y.

**DRILLS, Portable pneumatic**
Chicago Pneumatic Tool Co., New York 17, N. Y.

**DRILLS, Ratchet**
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Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
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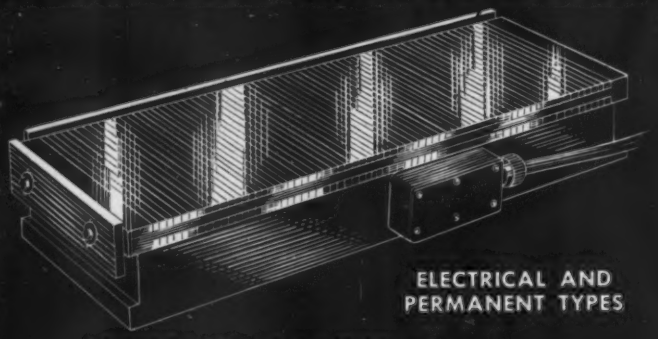
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Greenfield Tap & Die Corp., Greenfield, Mass.
Mohawk Tools, Inc., Montpelier, Ohio
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

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Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoALL Co., Des Plaines, Ill.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

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Cleveland Twist Drill Co., Cleveland, Ohio
Cogsdill Twist Drill Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.

**DUPLICATING ATTACHMENTS**—See Tracing Attachments

**DUST COLLECTORS AND CONTROL SYSTEMS**
Brown & Sharpe Mfg. Co., Providence, R. I.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Pangborn Corp., Hagerstown, Md.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 14, Ohio

**ELECTRICAL DISCHARGE MACHINES**
—See Disintegrators

**ELECTRONIC CONTROL SYSTEMS**
Micro-Path Inc., Ingelwood 2, Calif.
Stromberg-Carlson Div., General Dynamics Corp., 1493 N. Goodman St., Rochester 3, N. Y.

**ENGRAVING MACHINES**
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mach., 1321 Racine St., Racine, Wis.

**EXTRACTORS, Screw**
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Greenfield Tap & Die Corp., Greenfield, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Mummert-Dixon Co., Hanover, Pa.

**FANS, Exhaust, Ventilating**
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

**FASTENERS**
Allen Mfg. Co., Bloomfield, Conn.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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**1952 MODEL V36 MACHINE**

Obsolete fixed table machines were terrific in their day, using carbon steel blades and manual feed to cut mild steel at a rate of 1.7 sq. in./min.

**1959 CONTOUR-MATIC* MACHINE**

. . . has hydraulically-powered work table and Demon* H.S.S. saw blade to cut mild steel at 10.1 sq. in./min.

## They Look Alike...But *LOOK* at the *DIFFERENCE!*

You'll be amazed at the increased cutting rates, accuracy and finish achieved by new Contour-matic band machines. Here's a typical case:

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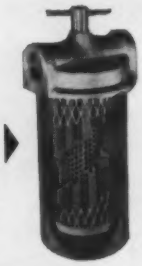
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**PIPE SIZES:** ¾"—1"—1¼"—1½"—2"—2½" and 3".
**CONNECTIONS:** Coupling—Male Nipple.
**BY-PASS VALVE:** Not Available.



**Synclinal LINE TYPE**

**CAPACITIES:** 5—8—10—20—30—50—75 and 100 G.P.M.
**PIPE SIZES:** ¾"—1"—1¼"—1½"—2"—2½" and 3".
**BY-PASS VALVE:** Not available.
**OPERATING PRESSURES:** Up to 80 p.s.i.



**Bonded SUMP TYPE**

**CAPACITIES:** 10—20—30—50 and 75 G.P.M.
**PIPE SIZES:** 1"—1¼"—1½"—2"—and 2½".
**CONNECTIONS:** Coupling—"O" Ring—Male Nipple.
**BY-PASS VALVE:** Available with or without



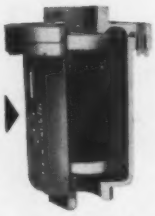
**Bonded LINE TYPE**

**CAPACITIES:** 10—20—30—50 and 75 G.P.M.
**PIPE SIZES:** 1"—1¼"—1½"—2" and 2½".
**BY-PASS VALVE:** Available with or without.
**OPERATING PRESSURE:** Up to 250 p.s.i.
**OPERATING TEMPERATURES** up to 300° F.



**Tandem SUMP TYPE**

**CAPACITIES:** 10—16—20—40—60—100—150 and 200 G.P.M.
**PIPE SIZES:** ¾"—1"—1¼"—1½"—2"—2½" and 3".
**CONNECTIONS:** Coupling—Male Nipple.
**BY-PASS VALVE:** Not available.



**IN-LINE FILTER**

**CAPACITIES:** Up to 60 G.P.M.
**PIPE SIZES:** ¾"—1"—1¼" and 1½" (at both inlet and outlet).
**BY-PASS VALVE:** Available with or without

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Gear-O-Mation Div., Michigan Tool Co., 7171 McNichols Rd., Detroit 12, Mich.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.

**FILES, Band**
DoALL Co., Des Plaines, Ill.

**FILES, General-purpose, Swiss Pattern**
DoALL Co., Des Plaines, Ill.

**FILES AND BURRS, Rotary**
DoALL Co., Des Plaines, Ill.
Jarvis Corp., Middletown, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

**FILING MACHINES**
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DoALL Co., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

**FILTERS, Coolant and Oil**
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Cuno Engineering Corp., Meriden, Conn.
Johnson, S. C. & Son, Inc., Racine, Wis.
Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

**FLAME-HARDENING MACHINES**
Cincinnati Milling Machine Co., Meta-Dynamics Div., Marburg Ave., Cincinnati 9, Ohio
Gleason Works, 1000 University Ave., Rochester 3, N. Y.

**FLEXIBLE SHAFT EQUIPMENT**
Jarvis Corp., Middletown, Conn.

**FORGING HAMMERS, Steam and Air**
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.

**FORGING MACHINES, Headers, Upsetters, Presses**
Ajax Mfg. Co., 1441 Chardon Rd., Cleveland 17, Ohio
Bliss, E. W. Co., 1375 Raff Rd. S. W. Canton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
National Machinery Co., Tiffin, Ohio
Waterbury Farrel Foundry & Mch. Co., Waterbury, Conn.

**FORGING, Hollow-Bored**
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.

**FORGINGS, Drop**
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.
Wyman-Gordon Co., Worcester, Mass.

**FORGINGS, Press**
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Minster Mch. Co., Minster, Ohio
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y. (die-pressed)
Vanadium-Alloys Steel Co., Latrobe, Penna.
Wyman-Gordon Co., Worcester, Mass.

**FORGINGS, Upset**
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Vanadium-Alloys Steel Co., Latrobe, Penna.

**FORMING MACHINES, Cold-Rolling**
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Michigan Tool Co., Mount Gilead, Ohio
Detroit 12, Mich.
Niagara Mch. & Tool Works, 637 Northland Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio

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Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
U. S. Tool Co., Inc., 255 North Main St., Ampere, E. Orange, N. J.

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National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

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DoALL Co., Des Plaines, Ill.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

**GAGES, Air Comparator**
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Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

**GAGES, Automatic Sorting**
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Sheffield Corp., Box 893, Dayton 1, Ohio

**GAGES, DIAL, Bore, Height, Depth, Thread, Groove, etc.**
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Brown & Sharpe Mfg. Co., Providence, R. I.
Cadillac Gage Co., P. O. Box 3806, Detroit, Mich.
Comtor Co., 47 Farwell St., Watham 54, Mass.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
General Electric Co., Schenectady, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

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Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
General Electric Co., Schenectady, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

**GAGES, Grinding**
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Sheffield Corp., Box 893, Dayton 1, Ohio

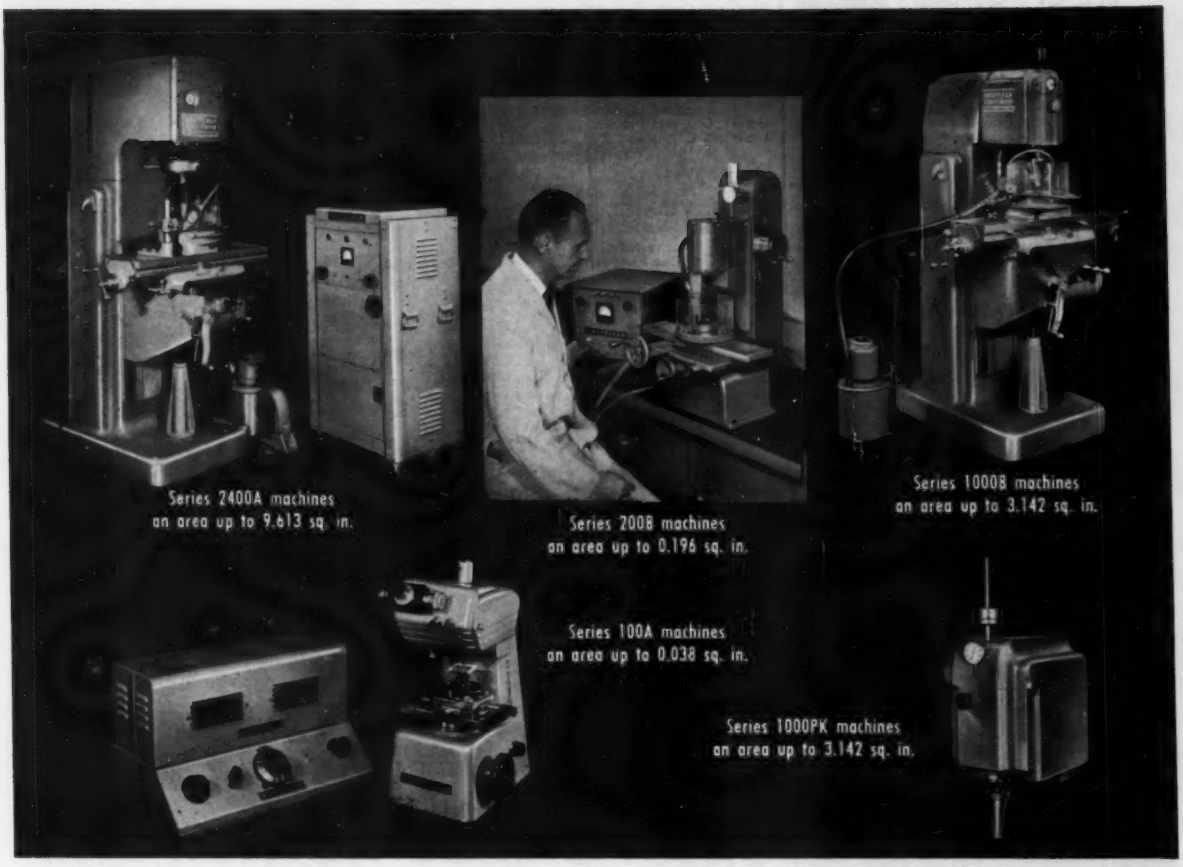
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Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**GAGES, Multiple Inspection**
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Sheffield Corp., Box 893, Dayton 1, Ohio

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Deltronic, Costa Mesa, Calif.
DoALL Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
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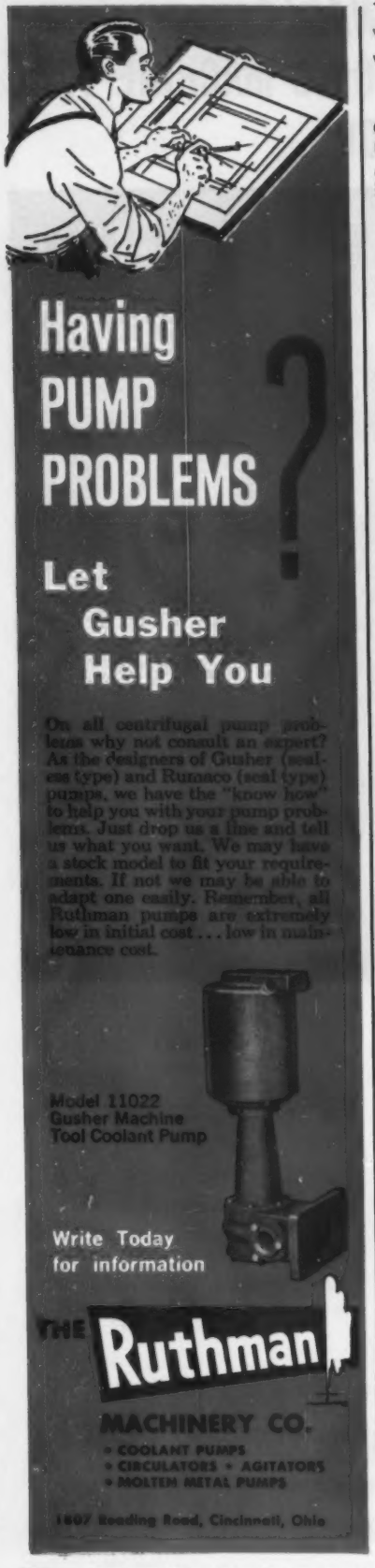
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Winter Bros. Co., Rochester, Mich.

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Sheffield Corp., Box 893, Dayton 1, Ohio

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DoALL Co., Des Plaines, Ill.
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Gleason Works, 1000 University Ave., Rochester 3, N. Y.
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Sheffield Corp., Box 893, Dayton 1, Ohio

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Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
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Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

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Gleason Works, 1000 University Ave., Rochester 3, N. Y.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
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Barber-Colman Co., 1300 Rock S., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springeld, Vt.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

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**GEAR LAPPERS**
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Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. Nichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean, Detroit 12, Mich.

**GEAR MOTORS**—See Speed Reducers

**GEAR RACKS**
Illinois Gear & Mch. Co., 2108 N. Natchez Ave., Chicago 5, Ill.
Stahl Gear & Mch. Co., The, 3901 Hamilton Ave., Cleveland 4, Ohio

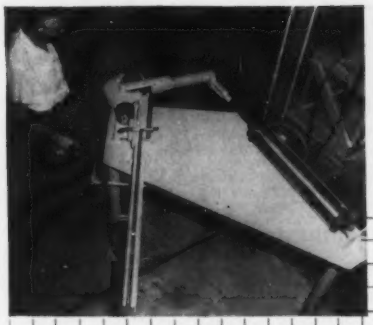
**GEAR SHAPERS**
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Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

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Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

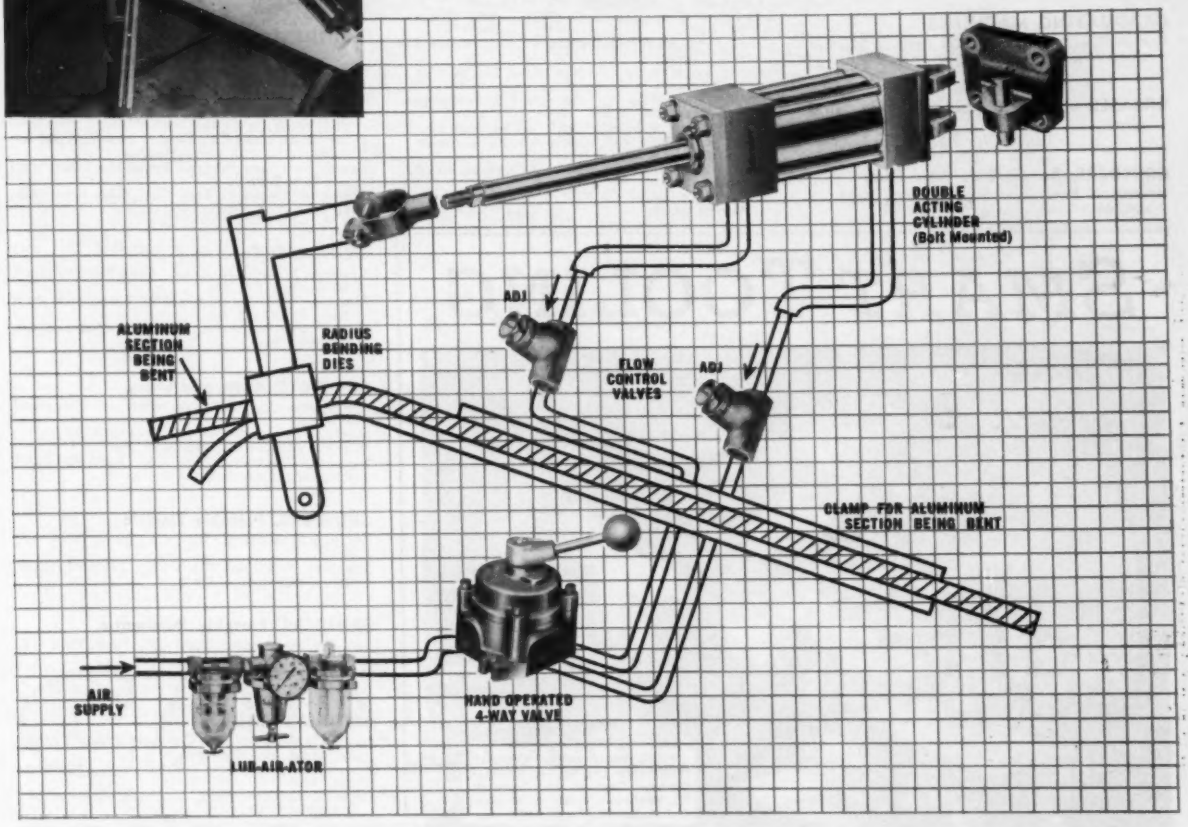
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Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
Illinois Gear & Mch. Co., 2108 N. Natchez Ave., Chicago 5, Ill.
New Jersey Gear & Mfg. Co., Hillside, N. J.
Ryerson, Jos. T. & Son, Inc., 16th and Rockwell St., Chicago 8, Ill.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio

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Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio

*(Continued on page 296)*



A typical example of how fabricators use Schrader. Schrader Air Products in the schematic perform a metal-forming operation at Lance Awning Corporation, Lake Worth, Florida. Power is supplied by a Schrader double-acting bolt-mounted air cylinder. By pressing the Schrader 4-way valve, the cylinder piston advances at proper speed, checked by Schrader flow control valves, bending an aluminum section to the desired angle. Reversal of the 4-way valve returns the cylinder and bending dies to rest, permitting removal of the bend section. "Air control provides a straightforward one-man job," says the Plant Manager. "Two men worked hard to form this radius bend on 25 parts per hour before a Schrader Air Cylinder was installed. Now one man forms 35."




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National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
New Jersey Gear Mfg. Co., 1470 Chestunt Ave., Hillside, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

**GRADUATING MACHINES**
Gorton Geo., Mch. Co., 1321 Racine St., Racine, Wis.

**GREASES**—See Lubricating Oils and Greases

**GRINDERS, Bench, Floor and Snag**
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Jones & Lamson Mch. Co., Springfield, Vt.
Mummurt-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

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DoALL Co., Des Plaines, Ill.
Elox Corp. of Michigan, Troy, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

**GRINDERS, Die and Mold**
DoALL Co., Des Plaines, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

**GRINDERS, Drill Point**
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Oliver Instrument Co., 1410 E. Maumee, Adrian Mich. (also drill point thinner)
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.

**GRINDERS, Face Mill**
Kearney & Treaker Corp., 6784 W. National, Milwaukee 14, Wis.
Mattison Machine Works 545 Blackhawk Park Ave., Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

**GRINDERS, Knife and Shear**
Hill Acme Co., 1201 W. 65th St. Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio

**GRINDERS, Portable Electric**
Chicago Pneumatic Tool Co., New York 17, N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio

**GRINDERS, Portable Pneumatic**
Chicago Pneumatic Tool Co., New York 17, N. Y.
Madison-Kipp Corp., Madison, Wis.

**GRINDERS, Tap**
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

**GRINDERS, Tool and Cutter**
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Milling Mch. Div., Marburg Ave., Cincinnati 9, Ohio
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Elox Corp. of Michigan, Troy, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton Geo., Mch. Co., 1321 Racine St., Racine, Wis.
Landis Tool Co., Waynesboro Pa.
LeBlond, R. K. Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder Co, 1500 W. Main St., Springfield, Ohio

**GRINDERS, Toolpost**
Cosa Corp., 305 Lexington Ave., New York 17, N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

**GRINDING GAGES**—See Gages, Grinding


# SMART TOOLING

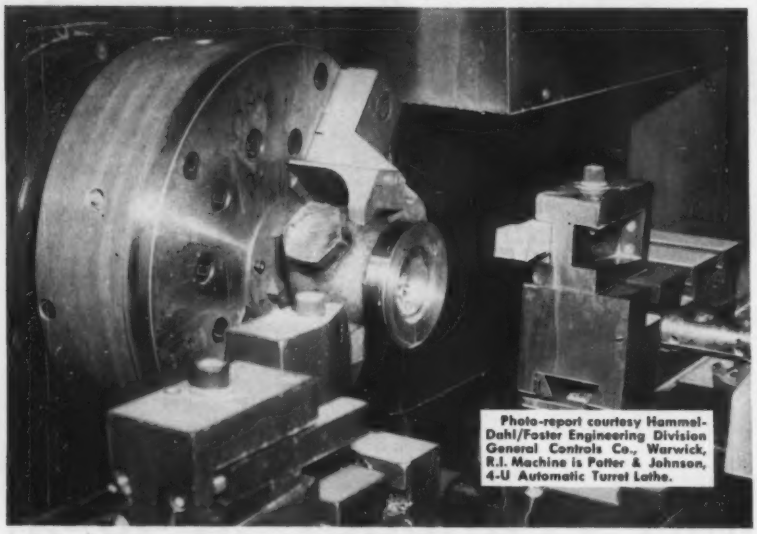


Photo-report courtesy Hammel-Dahl/Foster Engineering Division General Controls Co., Warwick, R.I. Machine is Potter & Johnson, 4-U Automatic Turret Lathe.

## Jumps production 8 to 40 pieces per day with *Buck* 15" Aluminum power chuck

The round valve body was hard to hold on a turret lathe with a 4-jaw chuck—and truing each piece took too much time and labor. Production was 1 piece per hour, only 8 a day.

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National Broach & Mch. Co., 5600 St. Jean Detroit 13, Mich.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder, 1534 W. Main, Springfield, Ohio

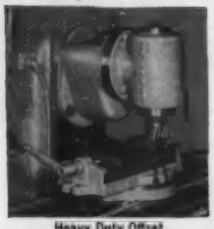
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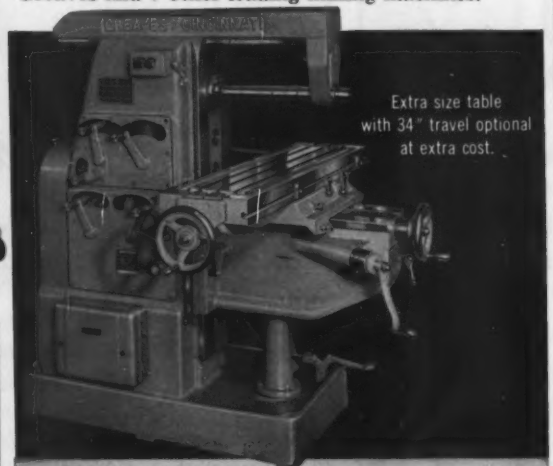

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Elox Corp. of Michigan, Troy, Mich.
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 4, Wis.
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Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Homestrand Inc., Larchmount, N. Y.
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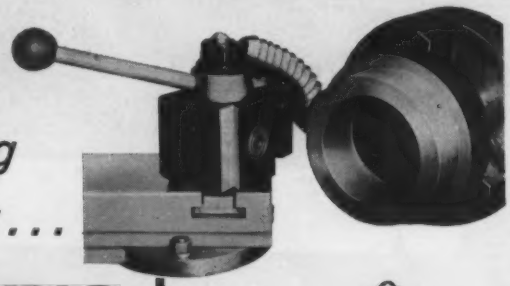
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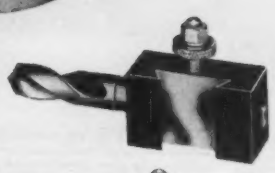
You can change quickly and easily from one lathe operation to another. To remove the tool and tool holder you are working with, simply flip the handle and slide the tool holder out. Slide in the second tool holder, with the locked in tool bit in the exact pre-set position, flip the handle back and you're ready to run. What's more, you eliminate entirely the use of shims as each Aloris Tool Holder has its own built-in height adjustment.

You can work with extreme accuracy, without chatter or vibration, when you use an Aloris Tool Holder. The life of your tools will be longer and they can be sharpened without removing them from the Tool Holder.

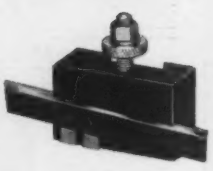
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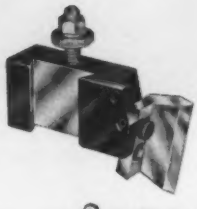
*P. S. To Management:*

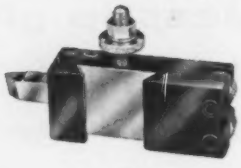
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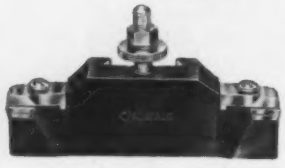


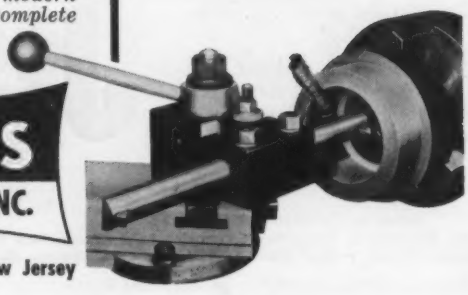












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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. Y.
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Station 4 — Multiple Tapping (Master Leadscrew Method)

Machine has:

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3 — 1 HP 900 RPM motors for Rapid Traverse Heads
1 — 7½ HP 1200 RPM motor operating Rotary Table.

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Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
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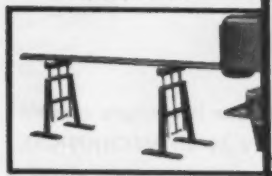



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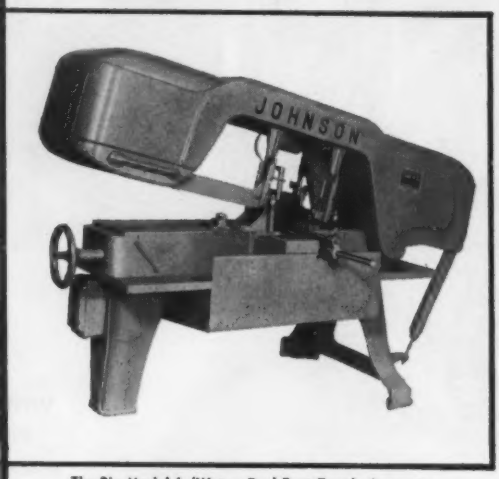
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Ames B. C., Waltham 54, Mass.
Brown & Sharpe Co., Providence, R. I.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
National Automatic Tool Co., S. 7th-N. Sts., Richmond, Ind.

### INDICATORS, Speed
Brown & Sharpe Mfg. Co., Providence, R. I.
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
General Electric Co., Schenectady, N. Y.

### INDICATORS, Test
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., 1144 Eddy St., Providence, R. I.
National Automatic Tool Co., S. 7th & N. Sts., Richmond, Ind.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

### INDUCTION HEATING EQUIPMENT
Cincinnati Milling Machine Co., Meta-Dynamics Div., Marburg Ave., Cincinnati 9, Ohio
General Electric Co., Schenectady, N. Y.
Lepel High Frequency Laboratories, Inc., Woodside 77, N. Y.
Orban, Kurt Co., Inc., 42 Echange Place, Jersey City 2, N. Y.

### INTENSIFIERS, Hydraulic
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.

**JACKS, Planer**—See Set-Up Equipment

### JIG BORERS
American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., Fair St., Royal Oak, Mich.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Homestrand, Inc., Larchmont, N. Y.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.
Orban Kurt., Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafavette St., New York 12, N. Y.

### JIGS AND FIXTURES
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Columbus Die Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Metal Carbides Corp., Youngstown 12, Ohio
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

### KEYSEATERS
Baker Bros Inc., Station F, P. O. Box 101, Toledo 10, Ohio
Bliss, E. W. Co., Canton, Ohio
Mitts & Merrill, 1809 S. Water St., Saginaw, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

### KNURLING TOOLS
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Williams J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

### LAPPING MACHINES
Cincinnati Milling Machine Co., Grinding Mch. Div., Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Norton Co., 1 New Bond St., Worcester 6. Mas.

### LATHE ATTACHMENTS
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio
Sheldon Mch. Co., Inc., 4235 N. Knox Ave., Chicago 41, Ill.
Sidney Mch. Tool Co., Sidney, Ohio
Williams J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**LATHES, AUTOMATIC**—See Chucking Machines

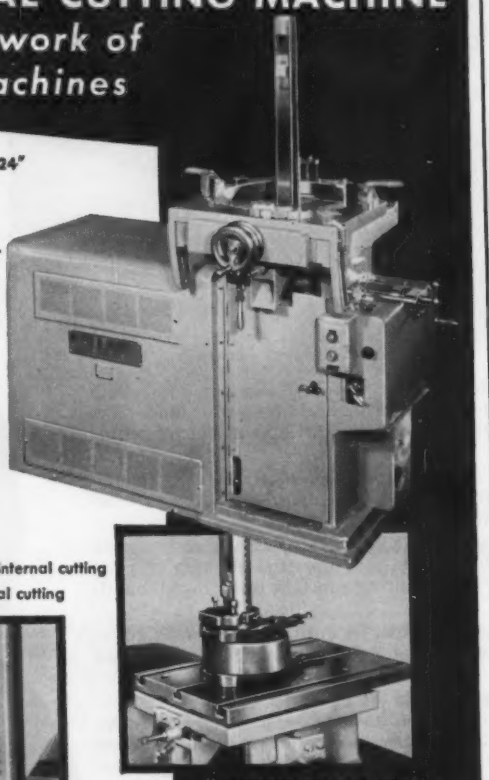
### LATHES, Axle
Consolidated Mch. Tool Div., Farrel-Birmingham Co., Inc., Rochester 10, N. Y.
Hamilton Div., Baldwin-Lima-Hamilton Corp. Hamilton, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt., Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

### LATHES, Bench
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros., Inc., 1420 Colege Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co, Madison and Edwards Rds. Cincinnati 18, Ohio
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

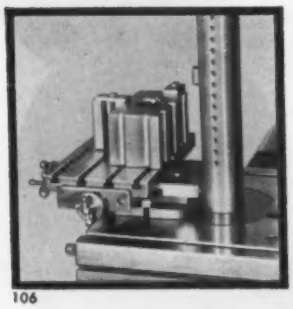

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Right: Set-up for internal cutting
Below: Set-up for external cutting





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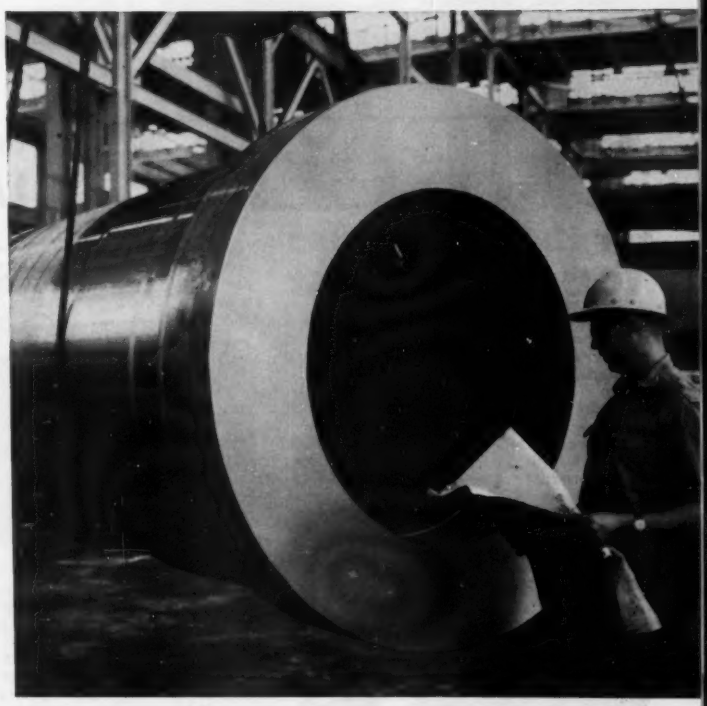
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# Bethlehem forged, rough-machined, and tested this cylinder in 6 weeks

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1/26/59

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### LATHES, Car Wheel

Bullard Co., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio

### LATHES, Copying, Duplicating — See Lathes, Duplicating

### LATHES, Crankshaft

Consolidated Mch Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds, Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

### LATHES, Double-End

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Consolidated Mch. Tool Corp., Rochester N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2351 11th St., Rockford, Ill.

### LATHES, Duplicating

Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney Ohio
Sidney Machine Tool Co., Highland Ave., Sidney, Ohio

### LATHES, Engine, Manufacturing

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Carroll-Jamieson Mch. Tool Co., Batavia, Ohio
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10 N. Y.
Hendey Mch. Div., Barber Colman Co., Rockford, Ill.
Homestrand, Inc., Larchmont, N. Y.
LeBlond, R. K. Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Mch. Tool Co., Sidney, Ohio

### LATHES, Engine, Toolroom

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Carroll-Jamieson Mach. Tool Co., Batavia, Ohio
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Hardinge Bros. Inc., 1420 Collge Ave., Elmira, N. Y.
Hendey Mch Div., Barber Colman Co., Rockford Ill.
Homestrand, Inc., Larchmont, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Logan Engineering Co., 4901 Lawrence Ave., Chicago 30, Ill.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio.
Orban, Kurt Co., Inc., 42 Exchange Place Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Mch. Tool Co., Sidney, Ohio

### LATHES, Gap

Cincinnati Lathe & Tool Co., 3207 Disney St. Cincinnati 9, Ohio
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Clearing Div., of U. S. Industries, Inc., 649 W. 65th St., Chicago 38, Ill.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio
Sidney Machine Tool Co., Highland Ave., Sidney, Ohio

### LATHES Hollow Spindle

LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.

### LATHES, Roll

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati 2, Ohio
Bliss E. W., Co., Canton, Ohio
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton Ohio
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

### LATHES, Speed, Second-operation

Clausing Div, Atlas Press Co., Kalamazoo, Mich.
Gisholt Machine Co., 1245 E Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Monarch Mch. Tool Co., Oak St., Sideny, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheldon Mch. Co., 4258 N. Knox Ave., Chicago 41, Ill.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

### LATHES, Spinning

Cincinnati Milling Machine Co., Meta-Dynamics Div., Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Lodge & Shipley Co., The, Cincinnati 25, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

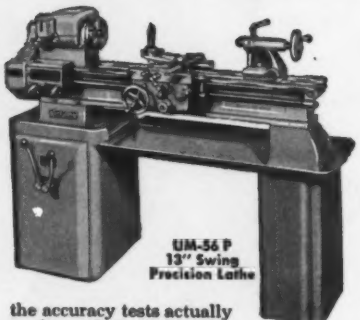

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UM-56 P
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Precision Lathe

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Precision Lathes



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Horizontal Milling Machine



SHELDON
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**LATHES, Toolroom**—See Lathes, Engine, Toolroom

**LATHES, Turret, Automatic**
Bullard Co., Bridgeport 2, Conn.
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Casa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springeld, Vt.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.

**LATHES Turret, Ram Type, Saddle Type**
Bardons & Oliver, Inc., 1133 W. Nnnth St., Cleveland 13, Ohio
Bullard Co., Bridgeport 2, Conn.
Clausing Div., Atlas Press Co., Kalamazoo, Mich.
Casa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., 1420 College Ave., Elmira N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.
Sheldon Mach. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

**LATHES, Turret, Vertical**—See Boring Mills, Vertical

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Miles Mchry. Co., 2025 E. Genessee Ave., Saginaw, Mich.
Motch & Merryweather Mchry. Co., 888 E. 70th St., Cleveland 3, Ohio
Van Keuren Co., Watertown 72, Mass.

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DoALL Co., Des Plaines, Ill.
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Van Keuren Co., 176 Waltham St., Watertown 72, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**MANDRELS**—See Arbors and Mandrels

**MARKING MACHINES and DEVICES**
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Pannier Corp., 319 Pannier Bldg., Pittsburgh 12, Pa.

**MATERIAL-HANDLING TRUCKS**—See Trucks, Material Handling

**MEASURING MACHINES**
Casa Corp., 405 Lexington Ave., New York 17, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Van Keuren Co., 176 Waltham St., Watertown 72, Mass.

**MEASURING WIRES—Thread, Spline, Gear**
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Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Van Keuren Co., 176 Waltham St., Watertown 72, Mass.

**MICROMETER HEADS**
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DoALL Co., Des Plaines, Ill.

**MICROMETERS, Outside, Inside, Depth**
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoALL Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Van Keuren Co., 176 Waltham St., Watertown 12, Mass.

**MICROSCOPES, Toolmakers'**
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Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

**MILLING MACHINE ATTACHMENTS**
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Milling Mch. Div., Marburg Ave., Cincinnati 9, Ohio
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
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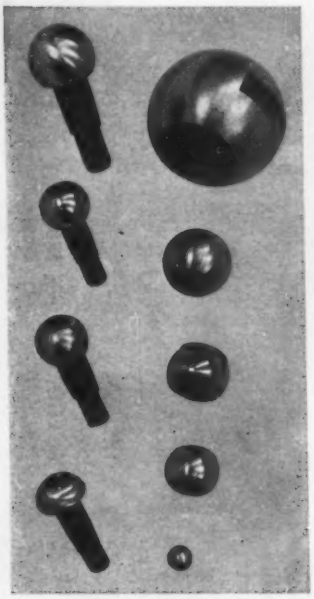
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# WHY PROCESSING TRUNCATED SPHERES BY MICROMATIC METHOD IS FASTER, ECONOMICAL AND MORE ACCURATE

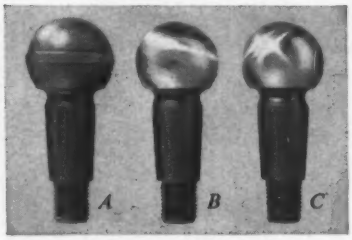
Machining of accurate truncated spheres has long been a design and production problem. The root of the problem lies in the fact that as a single point tool generates a spherical surface, the surface speed varies widely. To eliminate this problem, Micromatic has developed a fast, two-operation technique that assures uniform surface speed when machining any type of truncated sphere.



*The above ball studs and other truncated spheres are typical of parts that can be processed faster, to closer tolerances and at lower cost with Micromatic machines and tooling.*

First, a special cutting tool removes the bulk of excess stock from the forged part. For instance, here are the results obtained by a major automotive manufacturer: on a 1¼" diameter ball stud, approximately .060" of stock is removed from the ball in a 15-second floor-to-floor cycle. A finish of 40-60 microinches rms is obtained, total error in sphericity is held to .0005" and size is controlled within .001".

Microhoning is the second operation. In a 24-second floor-to-floor cycle, it removes final .002" of stock from the ball to generate required size, a finish of 6-10 microinches rms, sphericity within .0003" and a functional crosshatch lay pattern.




*Typical ball stud processing—(A) heat-treated forging, (B) after Micromatic cutting tool operation, (C) finished ball stud after Microhoning.*

See facing page for further details on how Micromatic processing of truncated spherical surfaces secures the above results.

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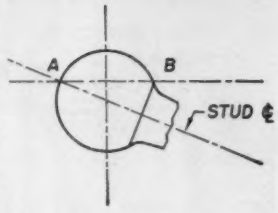
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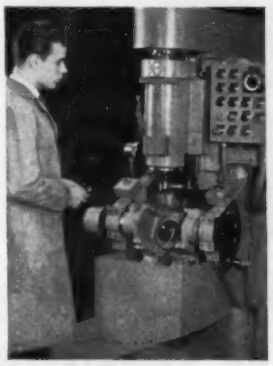
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*(Continued on page 312)*


# HOW PROCESSING TRUNCATED SPHERES BY MICROMATIC METHOD ASSURES ECONOMY, SPEED AND ACCURACY

As an example, here's how Micromatic equipment in two fast operations machines 1¼" diameter forged ball studs. For both operations, the ball stud is located on the taper, clamped in the thread and positioned on an inclined axis. Thus the center of the ball crown (A) and the intersecting point of sphere and shoulder (B) are in a horizontal plane.

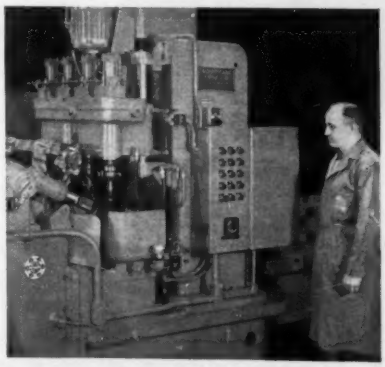


**FIRST OPERATION:** *Cutting excess stock from forged ball stud.*

The first machining of ball stud is a cutting operation. A special Micromatic cutting tool, that is U-shaped at the cutting end, is used to assure constant cutting speed over every point of the ball. Two round carboloy blades are clamped in the tool—clamp also acts as a chip breaker. With blades positioned in a counterbore, no adjustments are required. Size is controlled within .001" by depth of feed, set by an adjustable stop. Blades may be turned or reversed to give several usable cutting faces. Also, since they are throw-aways, these blades offer additional economies. Approximately 2,000 balls are machined with each set of blades. In a 15-second floor-to-floor cycle, the cutting operation is completed—total error in sphericity is held to .0005".

The ball is then Microhoned. The combination or rotating motions of workpiece and the special Microhoning tool results in a functional cross-hatch lay pattern and makes the abrasive self-dressing. In a 24-second floor-to-floor cycle, Microhoning generates required size, sphericity within .0003" and a finish of 6-10 microinches rms.



**SECOND OPERATION:** *Microhoning ball stud to secure final size, sphericity and finish. Single spindle machines also available.*

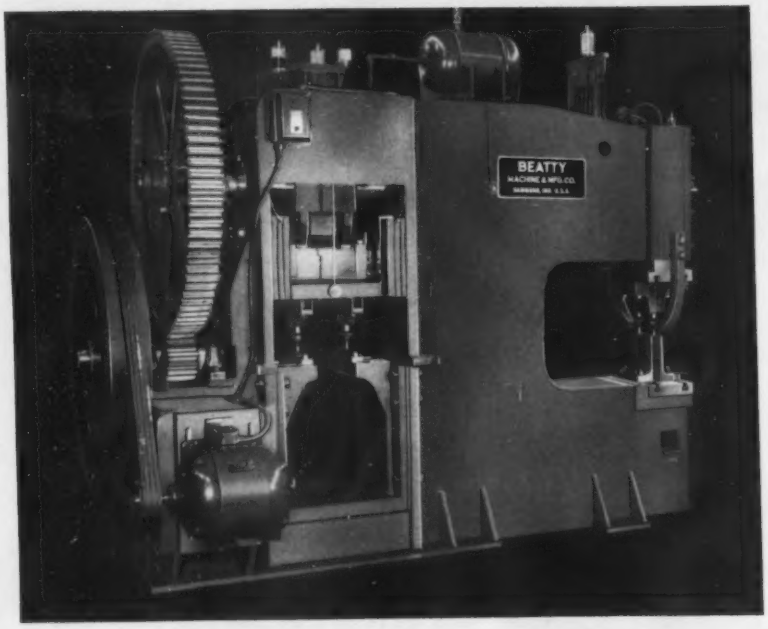
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# When Will ONE Machine Do The Work of THREE?




# WHEN IT'S A BEATTY DETAIL BEAM PUNCH

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**SPECIFICATIONS** — No. 7 Detail Beam Punch. Capacity: 100-tons or punching 1¼" hole through 1" mild steel.
WEB PUNCH END: Face of Ram, 6" x 18" — Face of Table, 6" x 18" — Distance ram to table, stroke up, 21¾" — Length of Stroke, 1¾" — Depth of Throat, 30". FLANGE PUNCH END: Opening through frame, 26" — Length of stroke, 2" — Distance ram to table, stroke up, 12".




**TOOL EQUIPMENT:** WEB PUNCH END — One set single gag punch tools for punching plates, angles, webs of beams, channels and shapes. FLANGE PUNCH END — Two sets of single gag punch units suitable for punching flanges of beams and channel sections.

Punch units for both ends are of the drop stem type for locating the punch in proper position.

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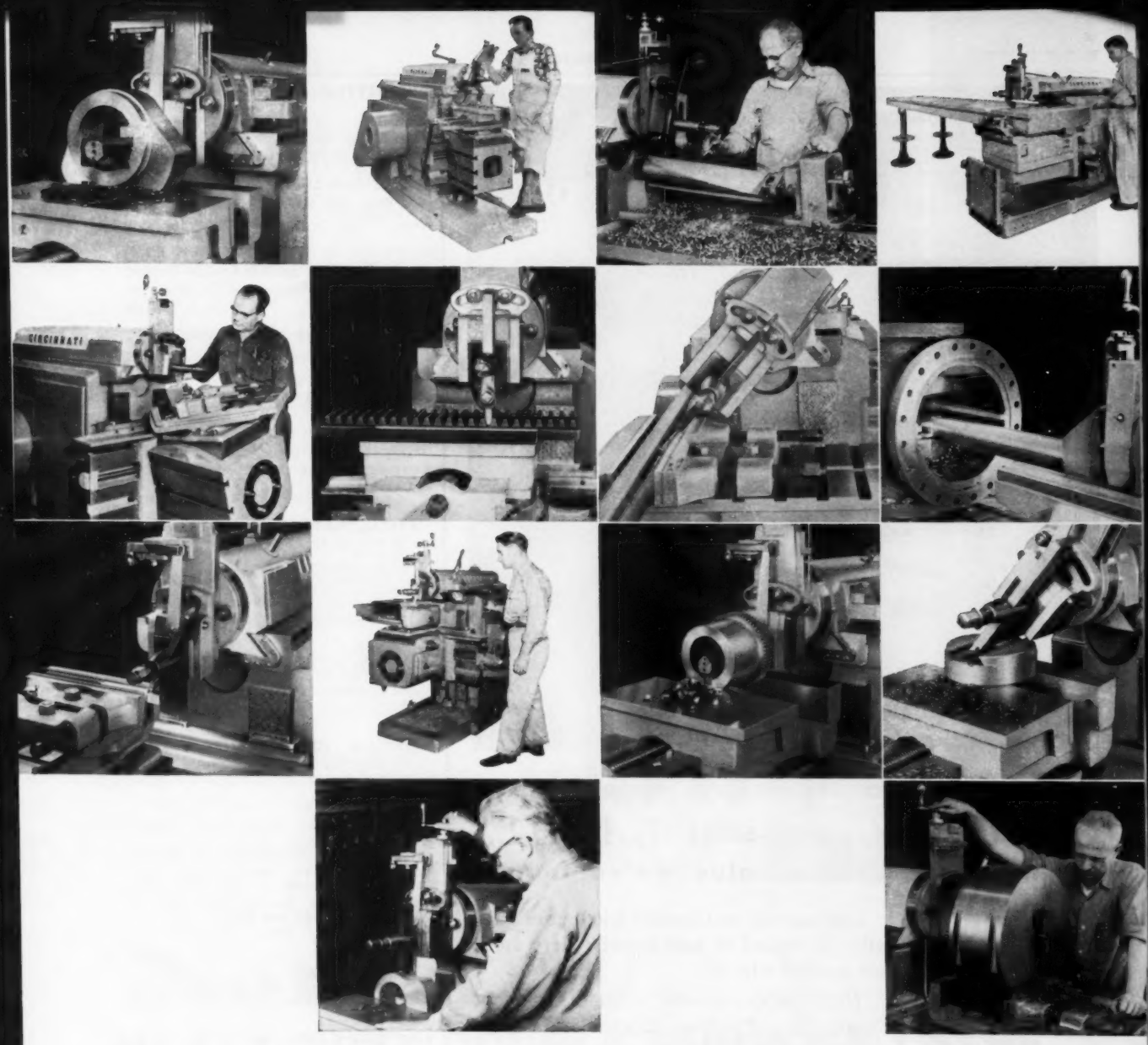
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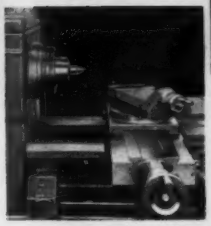
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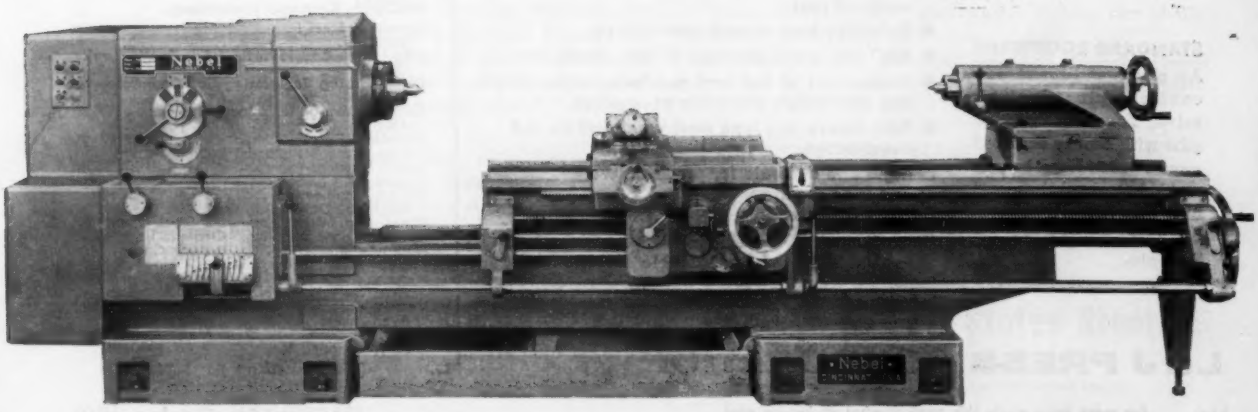


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Threadwell Tap & Die Corp., 16 Arch St., Greenfield, Mass.
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Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
U. S. Tool Co., Inc., 255 N. 8th St., Ampere, East Orange, N. J.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach.. Co., Waterbury, Conn.
Wilson, K. R., Inc., Arcade, N. Y.

**PRESSES, Briquetting**

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Denison Engineering Div., American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Wilson, K. R., Inc., Arcade, N. Y.

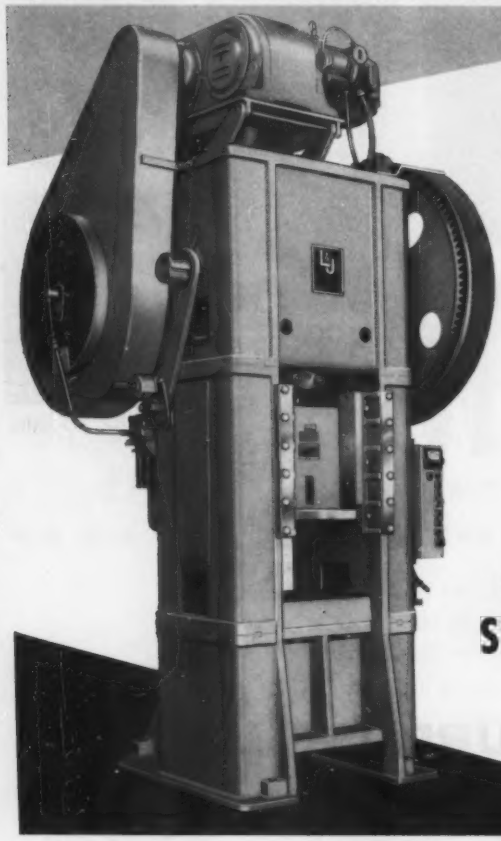
**PRESSES, Closed-Die Forging**

Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland 17, Ohio
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg Pa.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Hydraulic Press Mfg. Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.
Wood, R. D., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

**PRESSES, Coining, Embossing**

Birdsboro, Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties Inc., 2100 South Laramie, Chicago 50, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave. Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

*(Continued on page 318)*

**Accurate Efficient Dependable**

**L&J**

**SINGLE CRANK STRAIGHT SIDE PRESS**

**STANDARD EQUIPMENT**

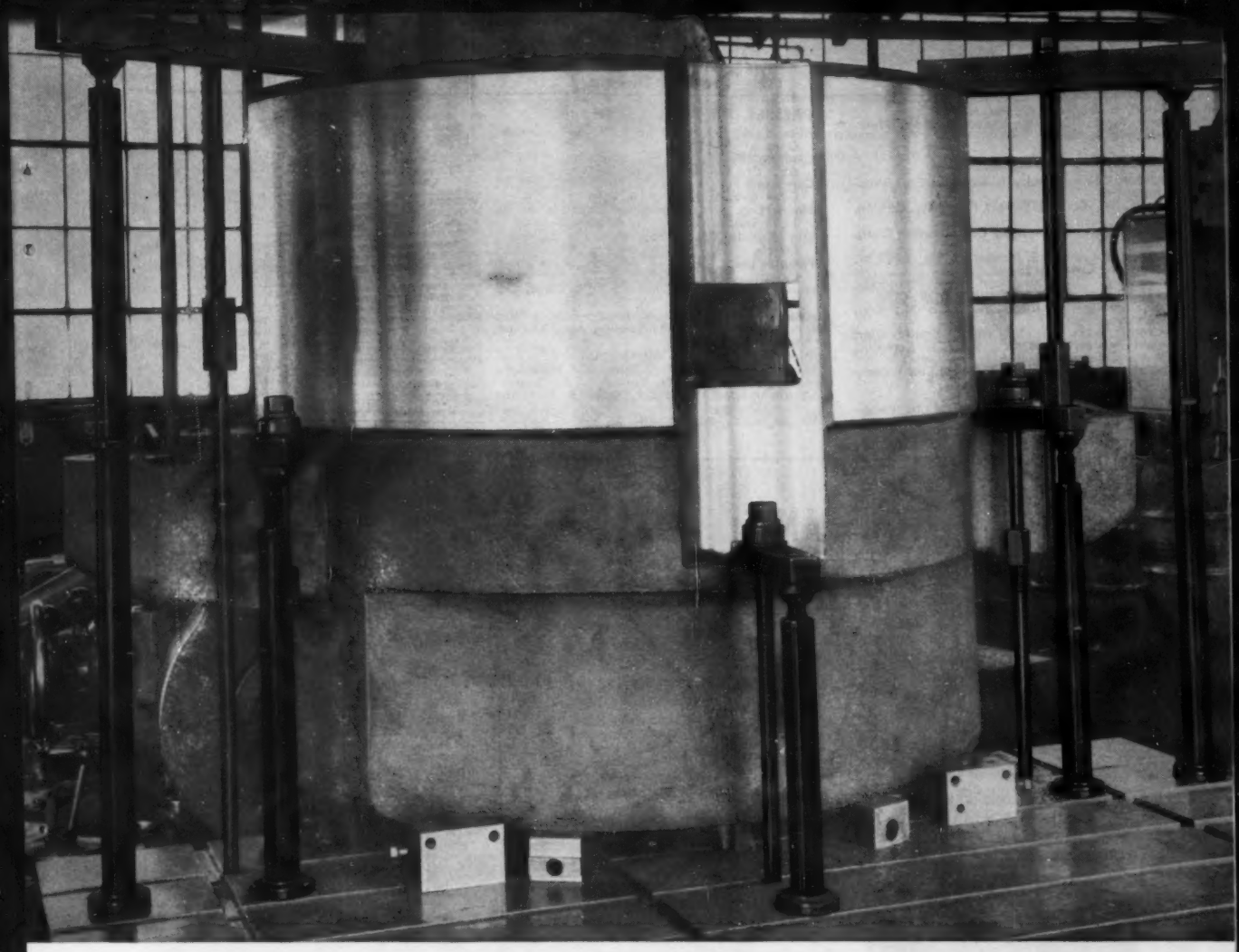
Air clutch and brake. IIC controls plus dual air valve. Four square type gibs with bronze surfaced ways on ram. Hard bronze crankshaft bushings and ball seat. Ram counterbalances. Forced lubrication, etc.

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- **Plain flywheel or back geared type.**
- **6½" dia. main bearings, 9" dia. crank pin.**
- **Dimensions of bed and ram face, stroke length and shut height available as required.**
- **Extra heavy box type steel weldment tie rod construction.**
- **Rigid and accurate for precision work and long die life.**



**Write** — Bulletin L-18 on 20 to 150 ton single and double crank straight side presses . . . also, 30 to 75 ton double crank gap frame presses.

**L&J PRESS CORPORATION** 1631 STERLING AVE. ELKHART, IND.



## Here's how Handy Clamp and Jack Set clamps down on machining costs . . .

# JACKS UP PRODUCT PERFORMANCE

USS National Seamless Mechanical Tubing helps one of our customers* do both. By using Mechanical Tubing in their clamp and jack sets, our customer finds it unnecessary to machine the ID before threading the ends; that painting requires no special preparation, and that, compared to bar stock, tubing is lighter to handle and ship. Three different sizes of sets are offered: 1" diameter, 1½" diameter and 1¾" diameter, all with 5/32-inch wall.

USS National Seamless Tubing helps cut processing costs because it eliminates drilling operations. It enables you to replace drills with simple, less expensive boring tools. And, it reduces tool wear and tool changes.

USS National Seamless Tubing gives you a superior cross section for a part that is designed to withstand equal loading in any direction. It resists bending stresses. It absorbs and localizes shock. And in torsion, it provides a better material distribution, and for a given weight, can withstand more load than other sections.

There's a National Tube Distributor located near you. He's expertly trained in solving all types of tubing problems. So, if you'd like to learn how USS National Seamless Steel Mechanical Tubing can be applied to your designs, see him . . . soon!

*USS and National are registered trademarks*

**Customer's name supplied on request.*

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**National Tube Division of United States Steel**

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
United States Steel Supply Division - United States Steel Export Company, New York

Wilson, K. R., Inc., Arcade, N. Y.
Wood, R. D., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

**PRESSES, Die Sinking (Hobbing)**

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S.W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.
Wilson, K. R., Inc., Arcade, N. Y.
Wood, R. D., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

**PRESSES, Die Tryout**

Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Federal Press Co., 511 Division St., Elkhart, Ind.
Hannifin Co., Div. Parker-Hannifin Corp., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

**PRESSES, Drawing**

Allen, Alva Industries, Clinton, Mo.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Cincinnati Milling Machine Co., Meta-Dynamics Div., Marburg Ave., Cincinnati 9, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.
Wilson, K. R., Inc., Arcade, N. Y.
Wood, R. D., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

**PRESSES, Extrusion**

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Clearing Div., of U.S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

**PRESSES, Foot**

Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.
Wilson, K. R., Inc., Arcade, N. Y.

**PRESSES, Horning**

Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wood, R. D., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

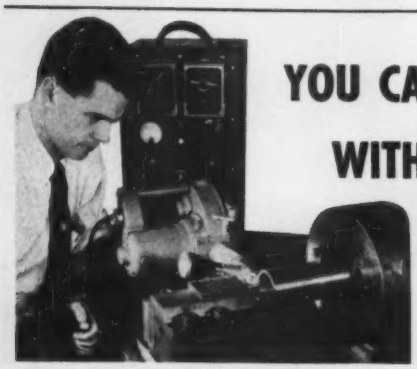
**PRESSES, Notching**

Allen Alva Industries, Clinton, Mo.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wales-Strippit, Inc., Akron, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

**PRESSES, Punching, Piercing**

Allen, Alva Industries, Clinton, Mo.
Beatty Machine & Mfg. Co., Hammond, Ind.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S.W., Canton, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.

*(Continued on page 320)*

YOU CAN SEE **WHY** WITH ***FASTAX***

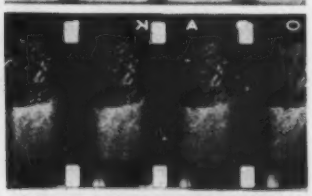
**PROBLEM:** *Differences in power consumption, chip formation and tool life when machining Titanium and steel.*

**SOLUTION:** *A high speed motion picture study of chip formation process of SAE 1020 and SAE 1112 steel being machined under same conditions as Titanium.*

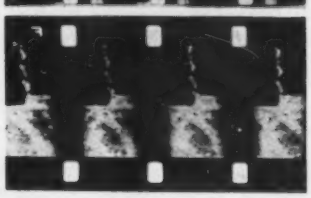
**1:** FASTAX High Speed Camera taking movies at 7,500 frames per second through a microscope. Actual frames from movies shown below.



**2:** SAE 1020 steel. Large built-up edge at cutting speed causes poor surface finish. Shear angle is low, resulting in very thick chip and consumption of considerable power in removing metal.



**3:** SAE 1112 steel. Built-up edge is absent due to lower friction on tool face . . . improved surface finish. Shear angle is higher and chip thinner. Power consumption is lessened.



**4:** TITANIUM (Ti 150A). No built-up edge. Surface finish is excellent. Shear angle high, but not constant in value. Chip forming process is cyclic. Since thin chip, power consumption is low. Tool life shorter because of metal structure.



This is just another industrial production problem solved through the eye of a FASTAX High Speed Motion Picture Camera—one of 26 different models available for solving *your* problems.

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# COST-CUTTING IDEAS THAT PAID OFF

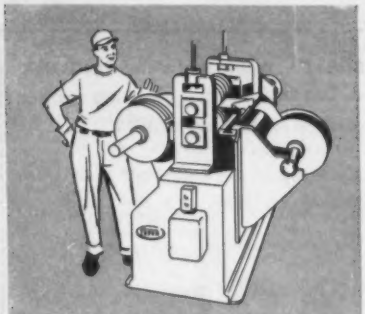
All the parts shown on the cover of the booklet were designed to serve a specific function—at a lower cost. Some of them are made from customer-owned tools, specially designed to make a better part at a saving in material cost and fabricating time. They illustrate only a few of the thousands of multiple-plunger and progressive-tool press products we supply to every branch of industry—from simple eyelets to precision electronic components.

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Perhaps we can develop cost-cutting ideas for you, too. The booklet describes and illustrates the range and types of parts we fabricate. A sample, drawing or description of a part you need to produce at a low cost will give our designers a chance to work on your cost problems—at no obligation to you.

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**MULTIPLE-PLUNGER PRESS PRODUCTS**


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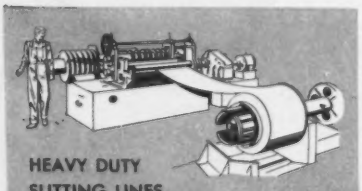
*basic equipment for cost-conscious users of strip!*

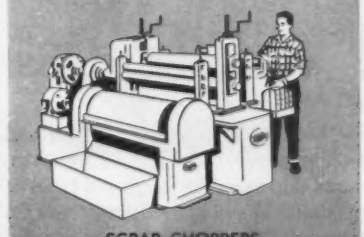
To help meet the demands of tight production schedules, YODER Slitters reduce mill-width stock quickly and economically to desired widths. If your needs are as low as 100 tons per month, time and manpower savings alone will offset the cost of your YODER Slitter in a matter of months, while reducing basic inventories. Compactly designed, standard YODER Slitters are built to handle standard coil widths... completely engineered lines for special requirements.

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Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave Chicago 19, Ill.
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Wood, R. D., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

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Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Hannifin Co., Div. Parker-Hannifin Corp., Des Plaines, Ill.
Hydraulic Press Mfg Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9303 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.
Wood, R. D., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

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B-T Machinery Co., Holland, Mich.
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Il.
Cleveland Punch & Shear Wks., Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Denison Engineering Div., American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Federal Press Co., 511 Division St., Elkhart, Ind.
Hannifin Co., Div. Parker-Hannifin Corp., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

**PROFILING MACHINES**—See Milling Machines, Die Sinking, etc.

**PULLEYS**
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DoALL Co., Des Plaines, Ill.

**PUMPS, Coolant and Lubricant**
Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Little Giant Pump Co., 5101 Classen Blvd., Oklahoma City 18, Okla.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 2, Ohio

**PUMPS, Hydraulic**
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Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Inc., Administrative & Engineering Center, Box 302, Detroit 32, Mich.
Wilson, K. R., Inc., Arcade, N. Y.

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DoALL Co., Des Plaines, Ill.
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Jarvis Corp., Stack Ave., Middletown, Conn.
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**RETAINING RINGS**
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Hannifin Co., Div. Parker-Hannifin Corp., Des Plaines, Ill.

**RIVETERS, Stationary**
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Tompkins-Johnson Co., Jackson, Mich.

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**RULES, SCALES AND STRAIGHTEDGES**
See Machinists' Small Tools

**RUST INHIBITORS**
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Shell Oil Co., 50 W. 50th St., New York, N. Y.
Stuart, D. A. Oil Co., Ltd., 2727 S. Troy St., Chicago 23, Ill.

**SAND BLAST EQUIPMENT**—See Blast Cleaning Equipment

**SAW BLADES, Hack, Band, Circular Friction**
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# You can have versatility in a big press




● 1500 ton Verson Crank Press piercing reinforcing angles. Material is 6" x 4" x ⅝" angle, 138" long. A two-station die pierces 18 holes in one leg, 14 in the other.

**THIS Verson CRANK PRESS PERFORMS UP TO FOUR OPERATIONS SIMULTANEOUSLY**




Descriptive bulletins are available on all Verson equipment. Write mentioning the type of equipment you are interested in.

While most people think of press versatility in connection with smaller presses, you can get versatility in big presses if you need it. You can get it, that is, if the press builder understands your production problems.

The Verson 1500 ton double crank press shown above is a good example. Installed in the Decatur (Ill.) plant of Caterpillar Tractor Co., it's a big press (bolster area 72" x 192", over 31' high, and weighing more than 180 tons). It operates at 16 strokes per minute. It is designed to J.I.C. specifications and features Verson Automatic Cascade lubrication to all points of the press. It is used for blanking and piercing on a wide variety of construction equipment parts, with as many as four operations performed simultaneously.

Most important, though, it fits the production processes of the plant in which it is used. And we at Verson believe the process is more important than the press.

If you would like to see what production-consciousness can mean to you, ask your Verson representative to go over your requirements with you. It could be the first step to bigger profits.

*Originators and pioneers of allsteel stamping press construction*

224

**VERSON ALLSTEEL PRESS CO.**

Verson

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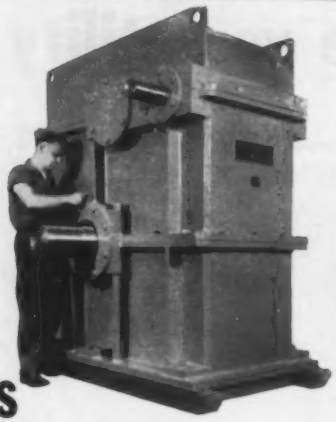
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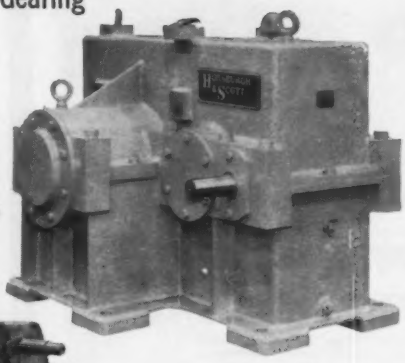
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DoALL Co., Des Plaines, Ill.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio

**SAW BLADE SHARPENERS**
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio

**SAWING MACHINES, Abrasive Machines**—See Cutting-off Saws, Abrasive Wheel

**SAWING MACHINES, Band**
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoALL Co., Des Plaines, Ill.

**SAWING MACHINES, Circular Blade**
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio
Ty-Sa-Man Machine Co., Inc., 1093 White Ave., Knoxville, Tenn.

**SAWING MACHINES, Power Hack**
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.

**SAWS, Screw-slotting**—See Cutters, Milling

**SCREW DRIVERS, STUD AND NUT SETTERS, Power**
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York N. Y.
Consolidated Mch. Tool Div., Blossom Road Rochester 10, N. Y.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**SCREW MACHINES, Hand**—See Lathes, Turret, Ram-type, Saddle-type

**SCREW MACHINES, Multiple-Spindle Automatic**
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
National Acme Co., 170 E. 31st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Scherr George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey Co., 6701 Carnegie Ave., Cleveland 3, Ohio

**SCREW MACHINES, Single-Spindle Automatic**
Brown & Sharpe Mfg Co., Providence, R. I.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.

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Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio
Orban Kurt, Co., 42 Exchange Place, Jersey City 2, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

**SHAPERS, Vertical and Slotters**
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road Rochester 10, N. Y.
Orban, Kurt Co., 42 Exchange Place, Jersey City 2, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

**SHEARS, Alligator**
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio

**SHEARS, Guillotine Bar**
Beatty Machine & Mfg. Co., Hammond, Ind.

**SHEARS, Rotary**
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.

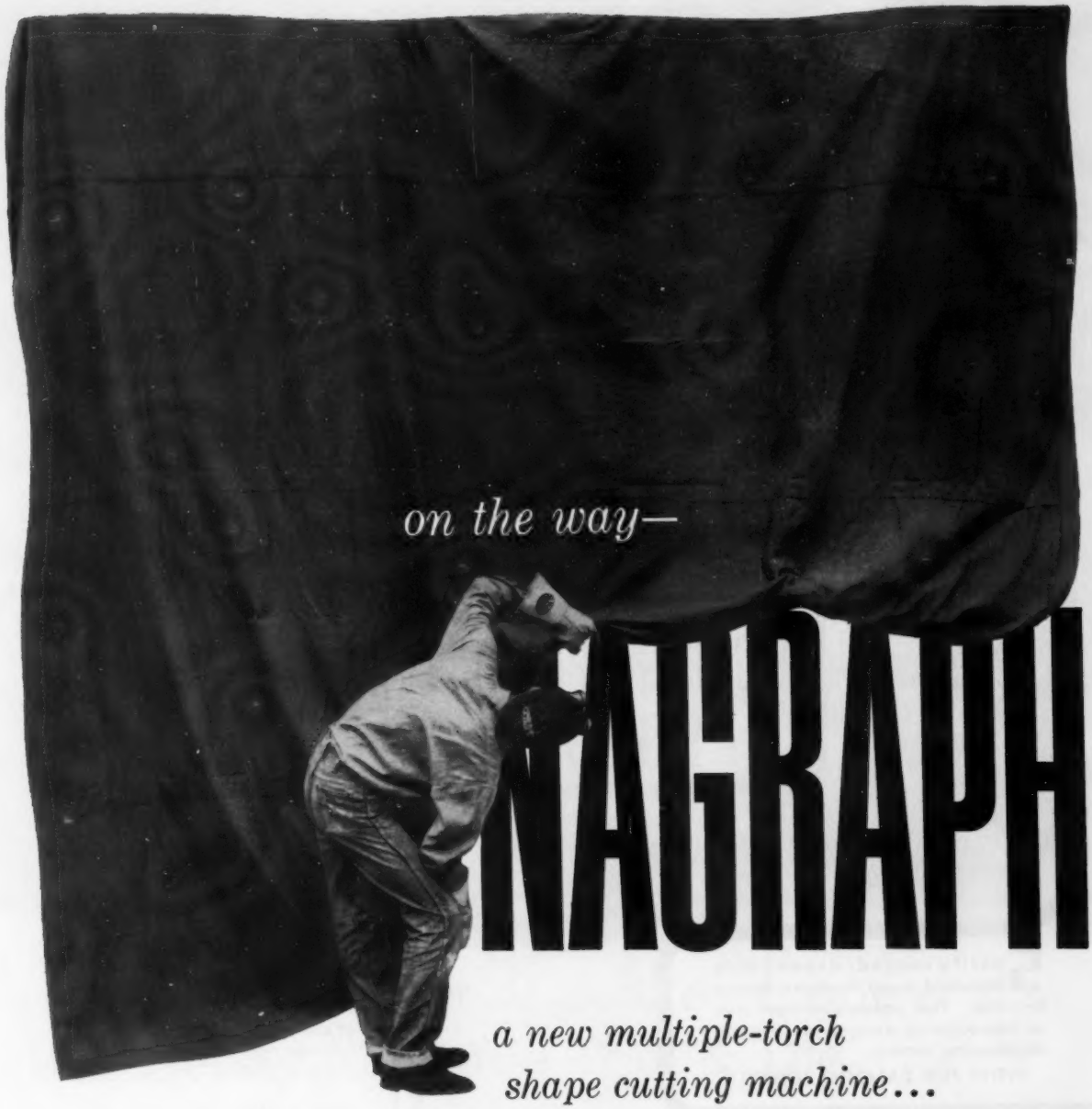
**SHEARS, Squaring**
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.

**SHEET METALS**—See Strip and Sheet, Ferrous, Non-ferrous

**SHIM STOCK**
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Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo 11, N. Y.
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Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge Mass.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Buhr Mch. Tool Co., 839 Green St., Ann Arbor Mich.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield Vt.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hannifin Co., Div. Parker-Hannifin Corp., Des Plaines, Ill.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Ingersoll Milling Machine Co., 505 Fulton Ave., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keen, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Motch & Merryweather Machy. Co., 888 E. 70th St., Cleveland 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Sheffield Corp., Box 893 Dayton 1, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.
Sundstrand Mch. & Tool Co., 2531 11th St., Rockford, Ill.
Universal Engrg. Co., Frankenmuth 2, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

**SPEED REDUCERS**

Barnes, John S. Corp., Rockford, Ill.
Boston Gear Works, 320 Main St., North Quincy 71, Mass.
General Electric Co., Schenectady, N. Y.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio.

**SPINDLES, Machine**

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th and N Sts., Richmond, Ind.
Standard Electrical Tool Co., 2488-90 River Road, Cincinnati, Ohio

**SPRAYING EQUIPMENT, Metal**

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**SPROCKETS**—See Gears, Cut

**STAMPINGS, Sheet Metal**

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Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

**STEEL ALLOYS**—See Alloy Steels

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Columbia Tool Steel Co., Chicago Hts., Ill.
Jessop Steel Co., Washington, Penna.
Ryerson, Jas. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Vanadium-Alloys Steel Co., Latrobe, Penna.
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Landis Mch. Co., Waynesboro, Pa.
Threadwell Tap & Die Co., Greenfield, Mass.







*courtesy Ready Machine Tool & Die Co., Inc.*

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Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

**STRIP AND SHEET, Ferrous**
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Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

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Bridgeport Brass Co., Bridgeport, Conn.
Jessop Steel Co., Washington, Penna.
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Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th and N Sts., Richmond, Ind.

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Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Jarvis Corp., Stack Ave., Middletown, Conn.
Kato Mfg. Co., Osaka, Japan.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
National Automatic Tool Co., S. 7th & N Sts., Richmond, Ind.
Thriftmaster Products Corp., 1014 N. Plum St., Lancaster, Pa.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

**TAPPING MACHINES**
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
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Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Cal.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.
Cincinnati Bickford Div. of Giddings & Lewis Mch. Tool Co., Oakley, Cincinnati 9, Ohio.
Cross Co., P. O. Box 3835, Park Grove Postal Sta. Detroit 5, Mich.
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Elox Corp. of Michigan, Troy, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowac, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Landis Mch. Co., Waynesboro, Pa.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 2, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

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Greenfield Tap & Die Corp., Greenfield, Mass.
Jarvis Corp., Stack Ave., Middletown, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

**TAPS, Collapsing**
Geometric-Horton Div., United Greenfield Corp., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co., Waynesboro, Pa.
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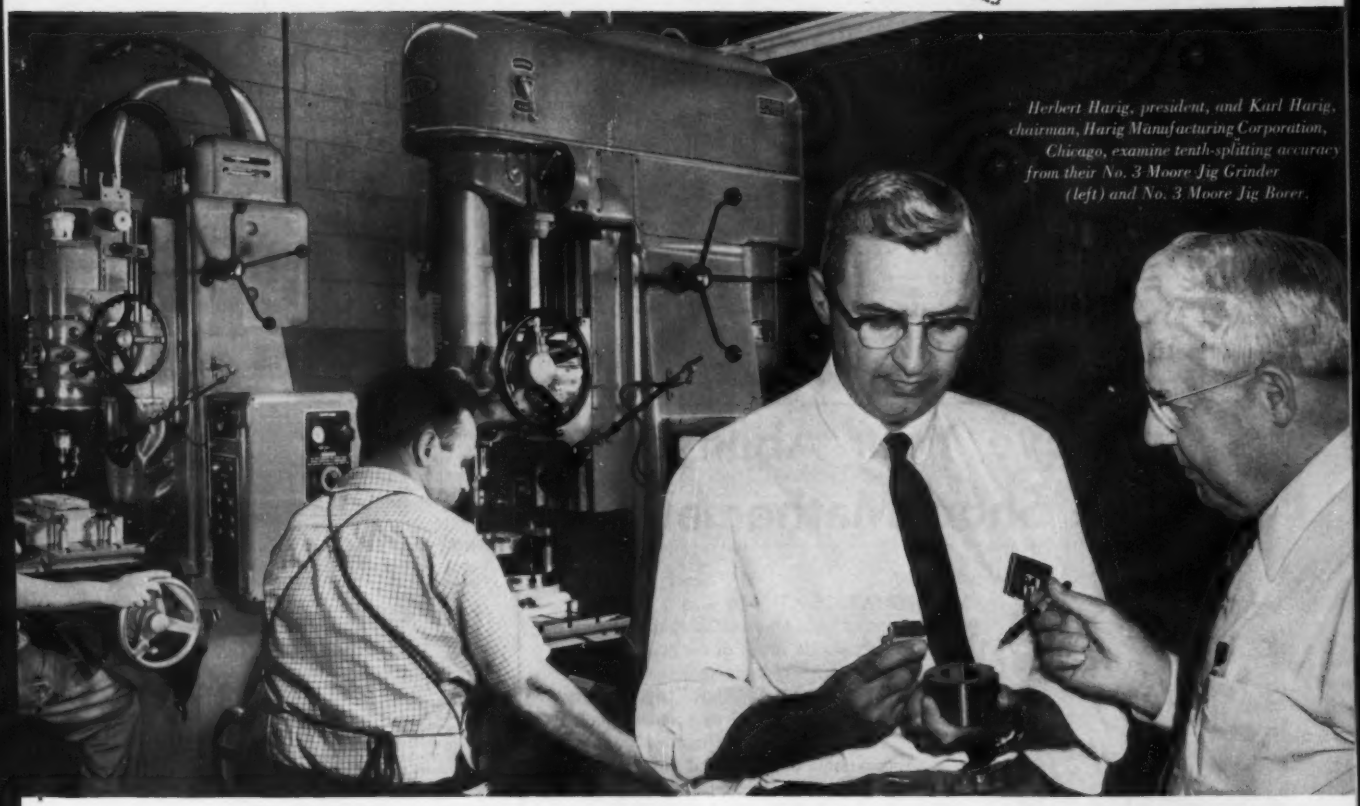
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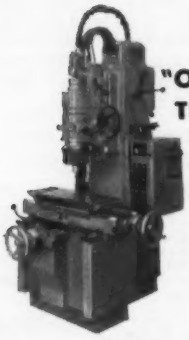
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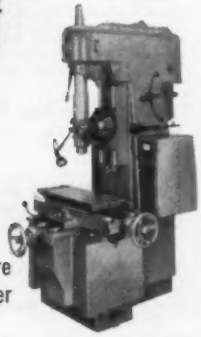
*Herbert Harig, president, and Karl Harig, chairman, Harig Manufacturing Corporation, Chicago, examine tenth-splitting accuracy from their No. 3 Moore Jig Grinder (left) and No. 3 Moore Jig Borer.*

# "We're now splitting tenths, thanks to Moore's new No. 3 Jig Borer and Jig Grinder"

**"Our operators feel these are the best machines they have ever worked on... They take care of the tenth-splitting tolerances required by industry today."**



No. 3 Moore Jig Grinder



No. 3 Moore Jig Borer

*Made and calibrated to the New International Inch.*

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We stand ready to help you duplicate Harig's record of satisfaction. As a start, write today for our detailed literature on these new tenth-splitting machines with larger tables; hardened, ground and lapped ways; no gibs, no overhang.

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Sheffield Corp., Box 893, Dayton 1, Ohio.

**THREAD ROLLING DIES**—See Dies, Thread Rolling

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National Machinery Co., Tiffin, Ohio.
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Sheffield Corp., Box 893, Dayton 1, Ohio
Waterbury Farrel Foundry & Mch. Co., Waterbury, Conn.

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Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond au Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
DoALL Co., Des Plaines, Ill.
Kennametal, Inc., Latrobe, Penna.
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
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Kennametal, Inc., Latrobe, Penna.
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du Mont Corp., Greenfield, Mass.
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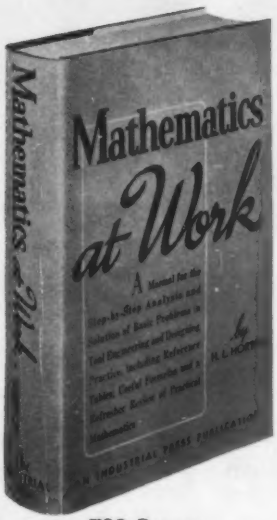
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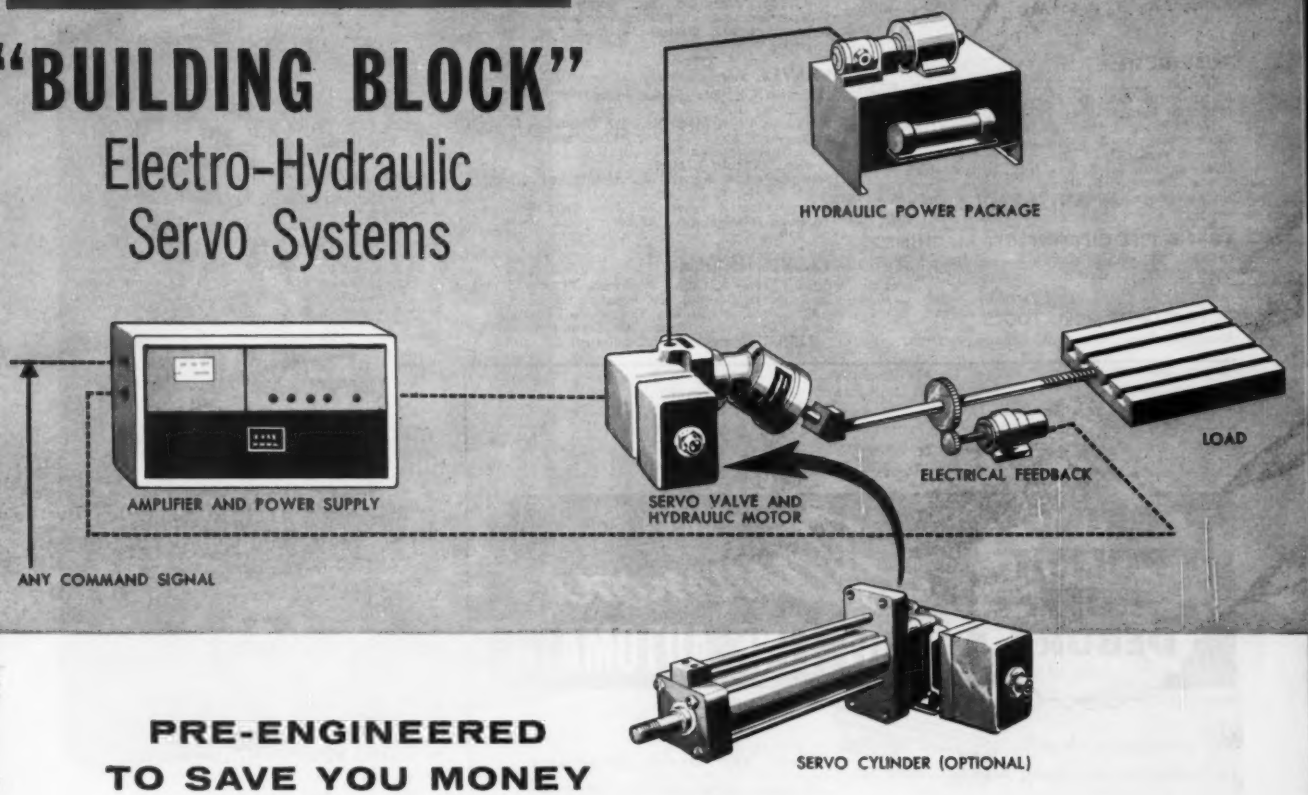
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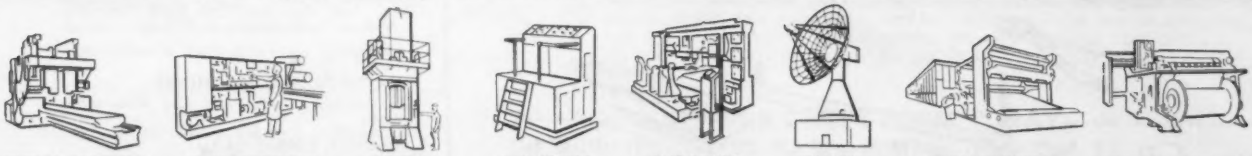

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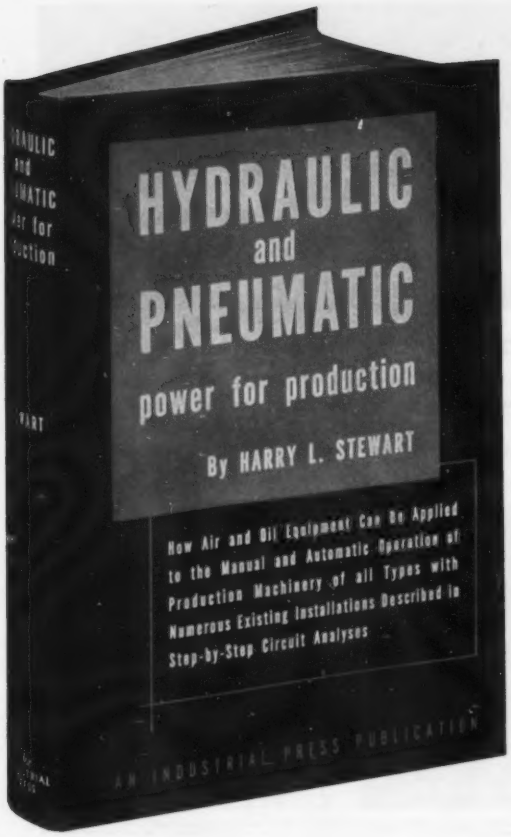
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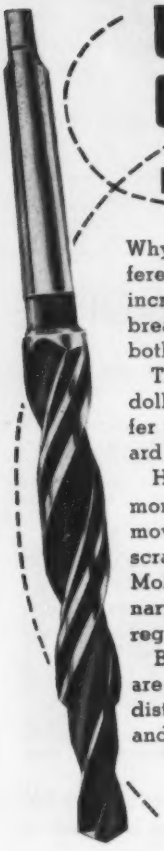
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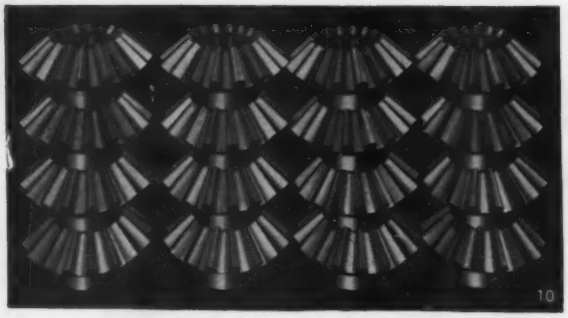

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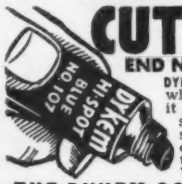
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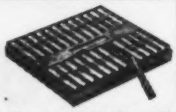
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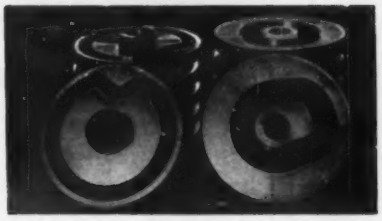


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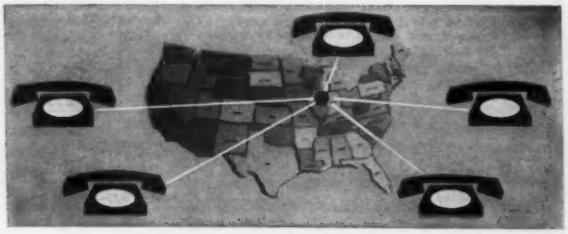


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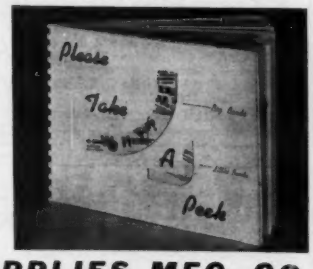
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**PLAIN MILLING MACHINES**

No. 1B Milwaukee, m.d., in rear
No. 2 Cincinnati H.P., m.d.
No. 2MH Cincinnati Plain, m.d.
No. 2MI Cincinnati, m.d. in base
No. 2K Kearney & Trecker, m.d.
No. 2B Brown & Sharpe, m.d.
No. 3B Milwaukee, m.d.
No. 3B Brown & Sharpe, m.d.
No. 3SP Van Norman, m.d.
No. 4H Kearney & Trecker, m.d.
No. 4 Cincinnati H.P., m.d.
No. 5 Cincinnati H.P., m.d., late
No. 2LP Van Norman, m.d.
No. 36 Van Norman Ram Type, m.d.

**THREAD MILLING MACHINES**

10x48" Hanson & Whitney Universal Semi-Automatic, m.d.
12x36" Lees-Bradner Universal Type, m.d.
12x54" Lees-Bradner Universal Type, m.d
12x102" Lees-Bradner Universal Type, m.d.
No. 40 Lees-Bradner Automatic Universal, m.d., late
Model HT—12x102" Lees-Bradner Universal Type, m.d.

**UNIVERSAL MILLING MACHINES**

No. 2 Brown & Sharpe Light Type, flanged m.d., late
No. 2 Kempsmith Master-Mill, Model EMB
No. 3A Brown & Sharpe Standard Type, m.d., late
No. 3K Kearney & Trecker, m.d.
No. 22LU Van Norman Ram Type, m.d.

**PLAIN CYLINDRICAL GRINDERS**

No. 5 Brown & Sharp Plain, m.d., 1942
No. 20—10x18" cap. Brown & Sharpe Plain, m.d.
4x12" Landis Type H Knee Hole Type, m.d.
6x15" Cincinnati Plain Hydraulic, m.d.
6x18" Cincinnati Model EA, m.d.
6x18" Landis Type C Hydraulic, m.d., late
6x18" Norton Plain Grinder, m.d.
10x18" Cincinnati Plain Hydraulic, Model ER, m.d., Filmatic Spindle, 1943
10x18" Cincinnati Model EA, m.d.
10x18" Norton Type C, m.d., latest
10x36" Cincinnati Hydraulic, m.d.
10x36" Norton Type C, m.d.
10x36" Landis Type CH Plain, m.d.
10x48" Cincinnati Model ER Plain Hydraulic, m.d.
12x36" Landis Plain Self-Contained, m.d.
14x36" Landis Type C, m.d., 1945
16x96" Cincinnati Plain, m.d.
16x40x120" Cincinnati Plain Heavy Duty, 1953
16x120" Landis Type B Plain H.D. Hydraulic, m.d., late
18x36" Landis Type C, m.d.
18x72" Norton Type C, mechanical, m.d.
20x72" Landis Type DC, m.d., 1944
23x36" ce Norton Type C, m.d.
23x72" ce Type C Norton Semi-Auto. Hydraulic
25x72" Landis Type C, m.d.

**MANUFACTURING LATHES**

20x25" Jones & Lamson Fay Automatic Lathe, 1944
No. 3 Lodge & Shipley Duomatic, m.d., late type
No. 3A Lodge & Shipley Duomatic, m.d.
No. 4 R. K. LeBlond Boring Lathe, 37" bed, 4" hole, m.d., latest
No. 9, 12 LeBlond Multi-Cut, m.d.
No. 12 Gisholt Auto. Fred., m.d.
No. 16 LeBlond Automatic, m.d.
4x60" LoSwing, m.d.
11x18" LeBlond Rapid Production, m.d.
12x18" Reid Small Piece Production, Model 6WBL, m.d.
Model U, 14x24" centers LoSwing, m.d.
No. 9WSL, Reid Production, m.d.
17x75-3/4" LeBlond, m.d.
No. 10 Sundstrand Automatic Production, m.d.
No. 12 Sundstrand Automatic Production, m.d.
14"x21' centers Model LS Semi-Automatic LoSwing, m.d.
Line Semi-Automatic Carbo Lathe, m.d.
Colburn Mfg. Bench Type Speed Lathe, m.d.
Model NA2B Schauer Speed Lathe
10x20" centers Hi-Turn, new

**HAND MILLERS**

No. 1M Kent-Owens, m.d., late

**MANUFACTURING TYPE MILLING MACHINES**

No. 00 Sundstrand Rigidmill, m.d.
No. 000 Brown & Sharpe Plain Production, m.d.
No. 08 Cincinnati, rise and fall, 1944
M80 Taylor & Fenn Duplex, spline, m.d.
No. MM-1-6 U.S. Multi-Miller, m.d.
No. 33H Sundstrand Trimplex Rigidmill, m.d.
No. 3A Sundstrand Plain Automatic Rigidmill, m.d.
24" Cincinnati Duplex Automatic, m.d.
54"x30"x16' Ingersoll Slab Miller, m.d.
Model 1404 Kearney & Trecker Simplex, m.d., production
No. 12 Brown & Sharpe Plain Horizontal, m.d.
No. 2-24 Cincinnati Plain Automatic, rise and fall, m.d.
3-24" Cincinnati Plain Hydromatic, m.d. in base
3-36" Cincinnati Duplex Hydromatic, m.d. in base
No. 4-36 Cincinnati Plain Hydromatic, m.d.
Model 33-1536 Sundstrand Simplex Fluid Screw Type Rigidmill, m.d.
No. 34-36 Cincinnati Semi-Special Plain Hydromatic, tracer control
28x144" Cincinnati Plain Hydromatic, m.d., late
56-96 Cincinnati Plain Hydromatic, m.d. in base, 1944
36x120" Cincinnati Horizontal Hydrotel Miller, pract. new, late

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Auto: 2" RB6 Acme-Gridley, 1944
Auto. Checker: 6½" No. 665 New Britain, 1943
Balancer: Tinius Olsen prop. shaft, 1948
Borer: DB1212A Ex-Cell-O, 1949
Boring Mill: 4" bar Universal, 60" vert., 1942
Boring Mills 5" Seifers 60" vert., 1941
Broach: 10 ton 54" American vert. duplex
Centering: 6" x 72" No. 56 Sundstrand
Compressor: 868 CFM Sullivan duplex, 125 HP
Drill, Deep Hole: 420 W. F. & John Barnes, 1942
Drill, Multiple: No. 4BL Natco, 36 spdl.
Drill, Upright: 21" Cin. Black. 1L superservice late
Drill, Radial: 4 11" Carlton, 1941
Drill, Hydr.: No. 25 Ex-Cell-O, late
Gear Hobber: No. 3 Barber Colman, pres., late
Grinder, C'less: No. 12 Landis, 1948
Grinder, C'less: No. 2 Cincinnati, filmatic
Grinder, C'less: No. 2 Cincinnati, filmatic
Grinder, Disc: 22" No. 221 Hanchett opposed
Grinder, Int.: No. 171 Heald sizematic, 1952
Grinder, Int.: No. 74 Heald, 1941
Grinder, T&C: No. 2 Cincinnati, 1944
Grinder, Univ.: 10x24 Landis, late
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Lathe, Auto.: 8 x 15" Sundstrand
Lathe, Auto.: No. 8 Gisholt, 1950
Lathes: 13 x 15", LeBlond Regal, 1956
Lathe: 16" x 54" American Precemaker, 1941
Lathe, Engine: 24" x 120" Monarch Model CM, 1943
Lathe: 25" x 72" Axelson, 1944 also 25" x 18
Lathe: 60" Lodge & Shipley "T" 1954
Lathe, turret: 9½" Hole No. 4L Gisholt
Lathe, turret: No. 4 J & L, prest. 1942
Mills, Boring: 60" Gisholt, vert. OCG
Mill, Boring: 100" Niles vert. PRT
Mills, Prd.: No. 33 Sundstrand Fluid-Screw, 1942
Mills, Prd.: No. 5-48 Cincinnati, late
Mill: No. 5H K&T, plain, vert. hd., 1941
Mill: No. 3KM K&T vert., 1943
Mill: 42" x 42" x 18" Ingersoll plainer type
Planer: 66" Rockford Hydr. open side, 1941
Press: 110 ton No. 675B Bliss, high speed
Press: 150 ton Lake Erie hydr. 1951
Press: 350 ton Eimes, hydr., 1944
Saw: 10" x 10" Racine shear cut
Slotter: 36" Rockford Hydr., 1943
Upsetter: 4" National air clutch, 1944

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2A BROWN & SHARPE Hi-Speed Univ. Mill, 1945.
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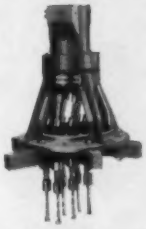
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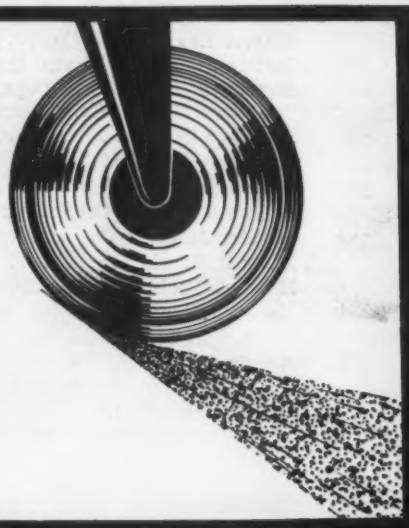
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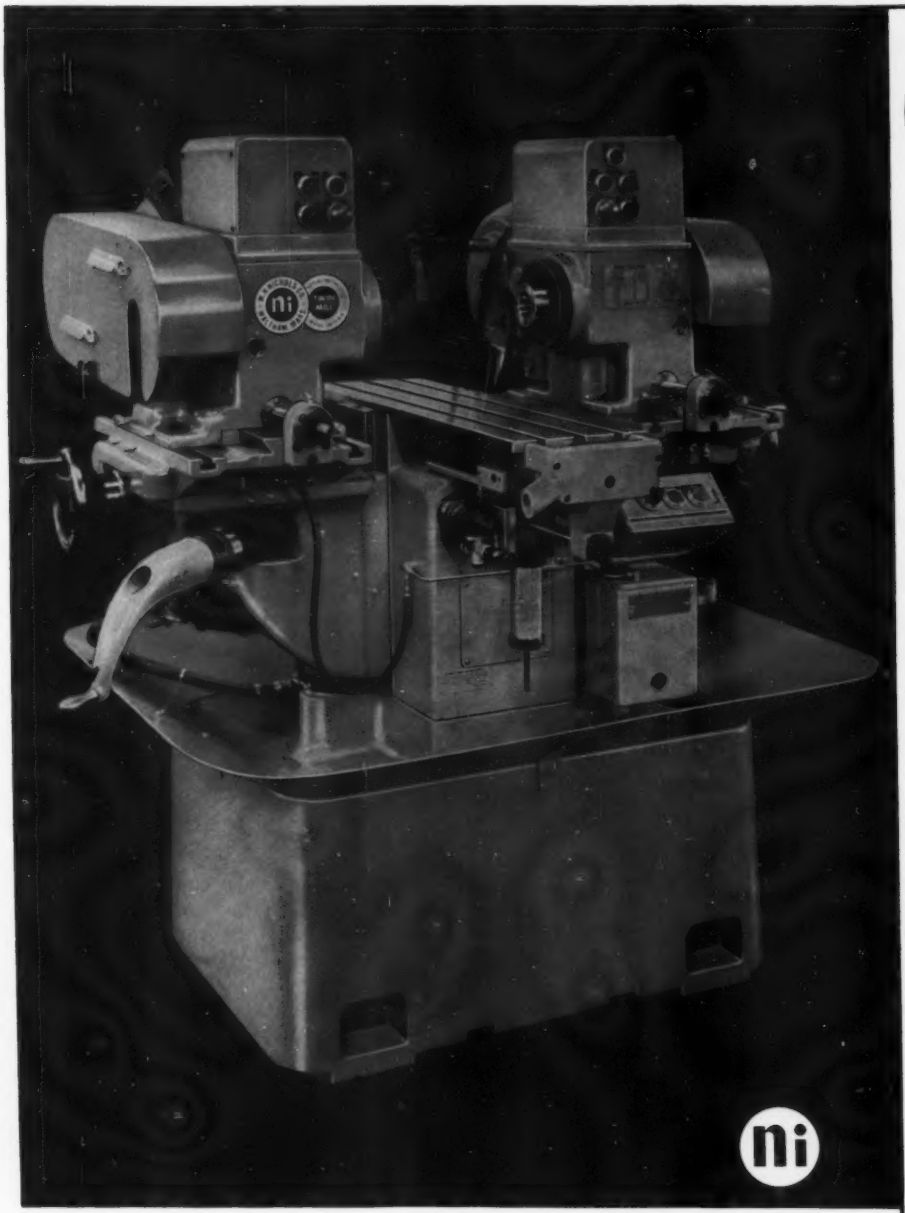
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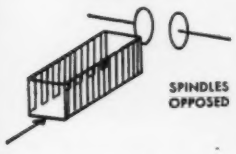


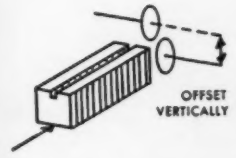

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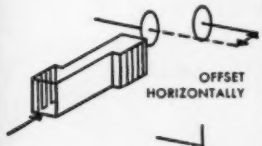
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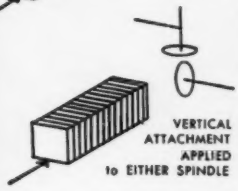


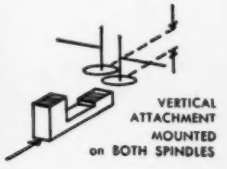
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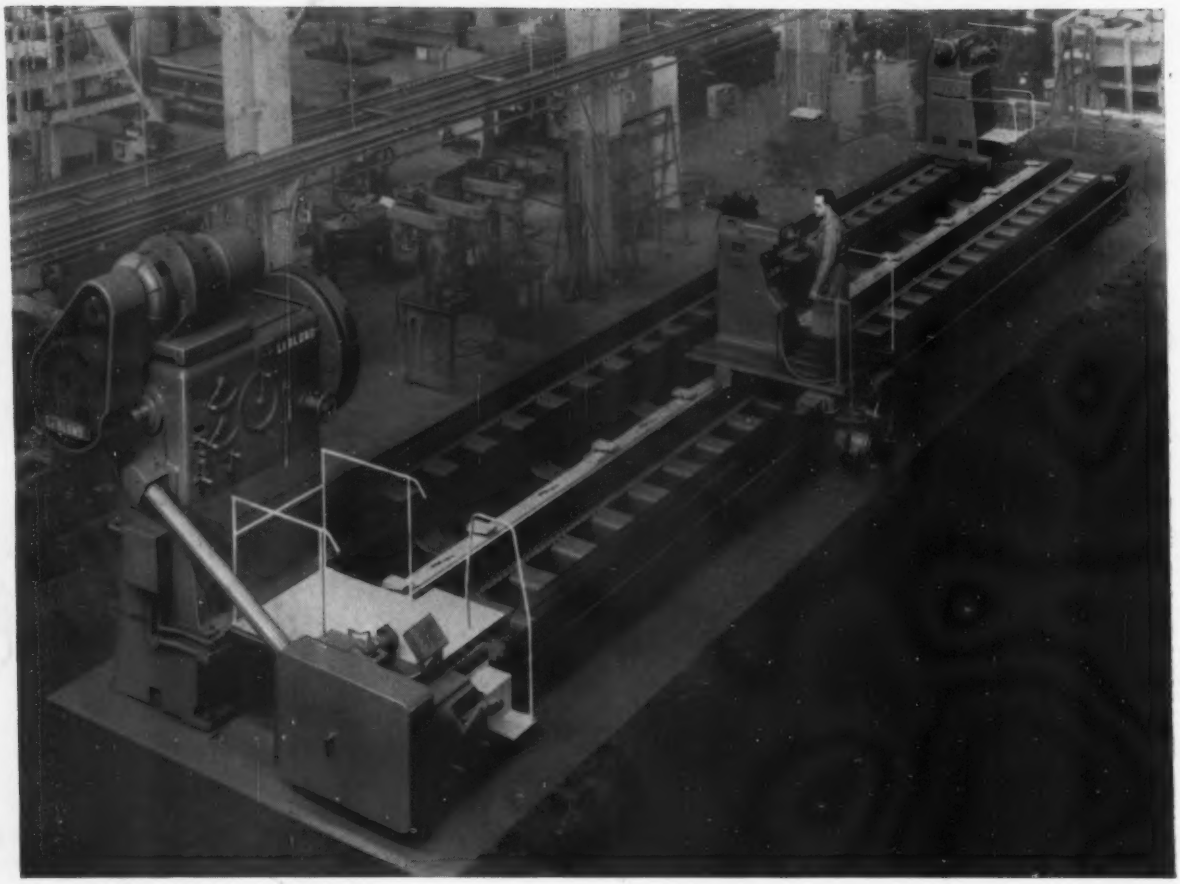
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